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Biological
& Medical
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JUNE, 1917.

ENTOMOLOGICAL NEWS

Vol. XXVIII. No. 6

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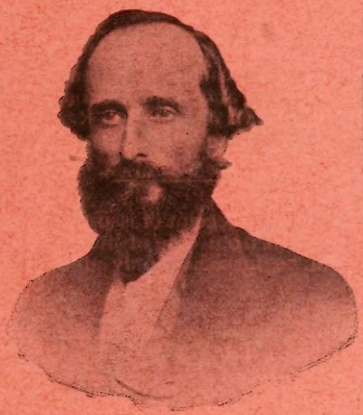

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PHILADELPHIA:
THE ACADEMY OF NATURAL SCIENCES,
LOGAN SQUARE.

Entered at the Philadelphia Post-Office as Second-Class Matter.

ENTOMOLOGICAL NEWS

published monthly, **excepting August and September**, in charge of the Entomological Section of The Academy of Natural Sciences, Philadelphia, and The American Entomological Society.

ANNUAL SUBSCRIPTION, $2.00 IN ADVANCE.

SINGLE COPIES 24 CENTS.

Advertising Rates: Per inch, full width of page, single insertion, $1.00; a discount of ten per cent. on insertions of five months or over. No advertisement taken for less than $1.00—Cash in advance.

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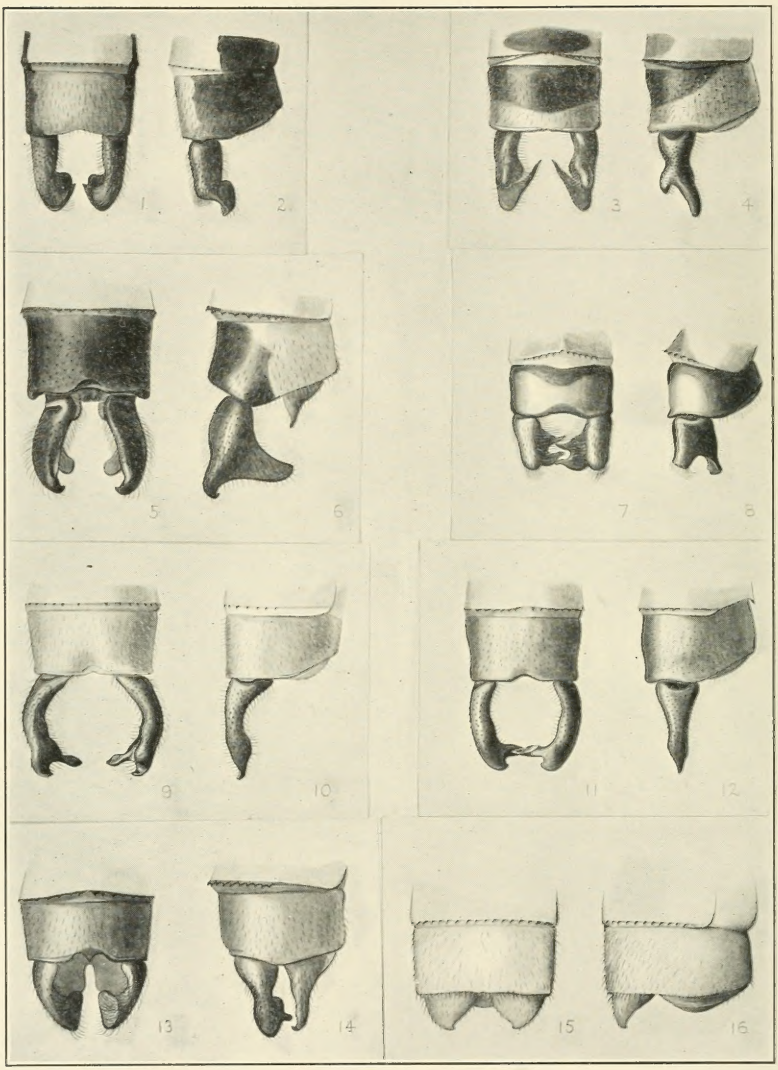

APPENDAGES OF LEPTAGRION AND AEOLAGRION MALES.—WILLIAMSON.

1, 2.—L. MACRURUM.
3, 4.—L. ANDROMACHE.
5, 6.—AE. DORSALE.
7, 8.—L. PORRECTUM.
9, 10.—L. ELONGATUM.
11, 12.—L. DISPAR.
13, 14.—AE. FLAMMEUM.
15, 16.—L? CROCEUM.

ENTOMOLOGICAL NEWS

AND

PROCEEDINGS OF THE ENTOMOLOGICAL SECTION

THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

VOL. XXVIII. JUNE, 1917. NO. 6.

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Some Species of Leptagrion with Descriptions of a new Genus and a new Species (Odonata).

By E. B. WILLIAMSON, Bluffton, Indiana.

(Plates XVII, XVIII.)

Foerster, in *Neotropische Libellen III* (Insekten Börse, XXIII, 1906), describes two new Neotropical Agrionine genera. One of these, *Skiallagma*, type *baueri* n. sp., known only from the male, is stated to be closely related to *Enallagma*, a view with which I can hardly agree, since against the *Enallagma*-like character of the quadrangle (which is not at all characteristic, by the way, being a common form of quadrangle) one can set at once the absence of postocular spots and the origin of A at the cubito-anal crossvein. Calvert (Ann. Carn. Mus. VI, p. 176) describes a second species, basing his generic determination, so he writes me, on the fact that his species seems to be close to *baueri*.

The second new genus proposed by Foerster is *Hylaeagrion*, of which *Leptagrion croceum*, of his determination must be the type, congeneric with which, according to Foerster, is his new *H. argenteolineatum*, known from the male only. The

new genus is separated, by Foerster, from *Leptagrion* by the presence of a vulvar spine in the female, by the unequal teeth of the tarsal claws, and by the form of the superior appendages of the male. But it seems impossible, after comparing Foerster's description of the male appendages of *croceum* with figures 15 and 16 of this paper, that his determination of *croceum* is correct. In fact I am convinced he had a *Leptobasis*, probably *vacillans* before him. As to his new species, *H. argenteolineatum*, I have no doubt this is really *Leptagrion dorsale*, a species in which the vulvar spine is wanting in the female. In *Leptobasis* the vulvar spine is normally present. It is true Calvert (Ann. Carn. Mus., VI, p. 201) describes a new *Leptobasis, mammilaris*, in which the single female lacks this spine. But Calvert's specimen was associated with the males only on supposition, and a female in my collection, which I think is a true *Leptobasis mammilaris*, is different and has the spine well developed.

The type of *Leptagrion* is *macrurum* Burmeister. Among the species associated under *Leptagrion* by de Selys it is proposed to recognize and describe a second genus **Aeolagrion**, type *Agrion dorsale* Burmeister. These two genera may be separated by the following key:

a^1. Descending crossvein from the subnodus not continued directly to the wing margin, the marginal cell, against which it ends, high and pentagonal, the adjoining marginal cells high and the hind margin of the wing full and rounded, nearly paralleling the front margin; M_2 in front wing arising at the sixth postnodal or more distad, in the hind wing at the fifth or more distad; R*s* and M_3 widely separated at the proximal crossvein between them; tooth on tarsal claw large, almost equalling the claw; male inferior appendages rudimentary.

Leptagrion.

a^2. Descending crossvein from the subnodus continuous to the wing margin, the marginal cells on either side of it low and quadrangular, the wing spatulate, the hind margin not paralleling the front margin: R*s* and M_3 narrowly separated at the proximal crossvein between them; tooth on tarsal claw well developed but distinctly shorter than claw; male inferior appendages well developed.

Aeolagrion. n. gen.

b^1. M_2 in front wing arising at the seventh postnodal, in the hind

wing at the sixth; A in front wing arising proximal to the cubito-anal crossvein*; cubito-anal crossvein in front wing distal to first antenodal nearly or slightly more than one-half the second antenodal costal space†, in hind wing more than one-half to nearly two-thirds ..... *A. flammeum.*

b². M_2 in front wing arising at the fifth postnodal, in the hind wing at the fourth; A in front wing arising at or distal to the cubito-anal crossvein; cubito-anal crossvein in front wing distal to first antenodal from one-fourth to one-third the second antenodal costal space, in hind wing less than one-half.

Other species of *Aeolagrion.*

Of *Leptagrion* I have 2 males each of *macrurum* and *andromache.* On the basis of description and figures only, *elongatum, porrectum* and *dispar* are also referred to the same genus. I know both sexes of *flammeum* and both sexes of *dorsale* and *demararum* n. sp. On the basis of descriptions only, it is probable *inca* and *obsoletum* belong here. I have no idea in what genus or genera the following species should be placed: *croceum, inornatum* and *rufum.*

An examination of the venational characters tabulated later in this paper will show a great deal of variation in relative lengths of the sides of the quadrangle. For example, in the front wing the anterior side may vary in the same species from about one-half the length of the proximal side to longer than the proximal side. Hence characters of the quadrangle based on single specimens are valueless.

The teeth on the tarsal claws seem to offer characters of value but are difficult of clear definition. Several species were studied in a comparative way and the following brief notes made: *macrurum,* tooth large, almost equalling claw‡.

*The editor calls my attention to the fact that fig. 20, pl. xviii, shows A *at* the crossvein. A reexamination of the wings themselves shows that A is really proximal to the crossvein.

†The space between the antenodals.

‡Of the two males studied, 3 of the 4 hind tarsi are malformed (?); these 3 tarsi are shortened, apparently 2-jointed, and terminated by a single greatly enlarged claw, with a nearly equal inferior tooth. Since this footnote was written Doctor Calvert has called my attention to Child and Young's *Regeneration of the Appendages in Nymphs of the Agrionidae* (Archiv f. Entwickelungsmechanik d. Organismen xv, 103, pp. 543-602, pls. xx-xxii), and he adds: "The cases to which your footnote refers are probably regenerated tarsi." Child and Young's paper is not in my library and I am unable to obtain a copy at this time.

andromache, similar to *macrurum; flammeum,* tooth well developed but distinctly shorter than claw, both tooth and tip of claw slenderer than in the preceding two species, the tooth not so divergent, the included angle more acute; *dorsale,* similar to *flammeum; demararum,* short as in *flammeum,* otherwise more like *macrurum; Leptobasis mammilaris* has the tooth still shorter, that is more basal, and weaker; in *Leptobasis vacillans* it is smaller than in *mammilaris.*

A study of the spines on the legs of various species shows a surprising variation in the number of spines and their distribution or spacing in each species, and no characters of specific or generic value have been detected. The closer spines are set together the longer they appear, other things being equal, since one estimates their length largely in terms of the interspaces.

Aeolagrion demararum n. sp. (Pl. XVIII, fig. 22, text figs. 17, 18). Abdomen ♂ 27-28, ♀ 27-30; hind wing, ♂ 16-17, ♀ 17.5-18.5.

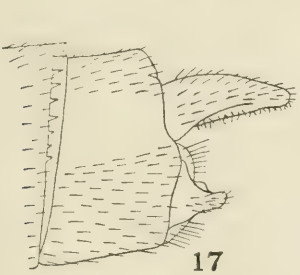
♂.—Labrum to median ocellus, including genae, light dull brown to bright blue green, with all intermediate stages, in specimens otherwise apparently of the same age, the green in transitional specimens appears first on labrum, rhinarium and nasus, and last on the frons above. Head above dark green to black, marked with dull orange in a varying degree; area enclosed by ocelli dark; from this dark area, posterior to the lateral ocelli, on either side a dark bar runs outward and forward, ending behind the antenna and reaching neither the antenna nor the eye; anterior to this bar the head is pale except that usually there is a short bar on either side of the median ocellus, reaching about half-way to the antenna; at its outer posterior portion the dark bar from each lateral ocellus joins with a large dark area which occupies the entire posterior dorsal surface of the head except a pale occipital crest with a dilatation of varying size at either end; in some specimens this pale occipital area is blue or green instead of dull orange. Usually the large posterior dark area rests against the eye, but it may be separated by the merest line of pale blue or green. In a few very mature specimens, as shown by the pruinescent under parts of the thorax, the occipital pale area is scarcely or not discernible, and the pale areas on either side and in front of the ocelli are very dark and obscure, so that, at first glance, the entire dorsal surface of the head, excepting the frons, appears black. Rear of head pale, white or bluish.

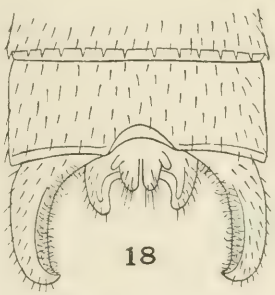
Prothorax with front lobe pale blue, the lateral margins light brown, to entirely bright blue; in paler individuals the middle and hind lobes

light brown with obscure darker shadings; in brighter individuals these lobes are rich reddish brown above, with a median longitudinal pale blue shading, and the sides blue; hind border wide, with round lateral wings and a rounded median border of the same height. Propleuron pale, almost white to bright blue.

Thorax above very variable; in all a dark metallic green middorsal stripe, on either side about one-fifth as wide as the mesepisternum, with the sides parallel, except at the extreme upper and lower ends; remainder of mesepisternum rust red and very variable; in some the color seems fairly uniform over the entire surface, but in most specimens there is a faint hint to a rather definite pale stripe on either side of the median dark green, and of about the same width; this stripe may show as a lighter rust red or parts of it may be greenish or bluish; in life in bright-colored individuals I recall it as an evanescent bright light blue stripe. Sides from the humeral suture light to bright blue; the mesepimeron usually slightly paler than the metepisternum and metepimeron, with a narrow posthumeral darker blue stripe; a small brown dot slightly above the middle of the first lateral suture and another near the upper end of the second lateral suture. In the case of a few very mature specimens the rust red of the mesepisternum has become almost or quite as dark as the middorsal stripe, in which case the pale stripe on either side of the dark middorsal stripe is distinct and well defined, rusty silvery white in color, the mesepimeron largely overlaid with silvery white, and the under parts and coxae with scattered powdery pruinescence. Coxae and beneath pale, cream or bluish.

Abdomen seen from above, 1 blue with a median brown spot which is usually pale centered; 2 blue with a wide longitudinal median brown, more or less black stripe, which is slightly widened basally and apically, not reaching the base which is pale, and usually slightly separated from the narrowly brown apex; 3 to 6 brown, shading





Aeolagrion demerarum n. sp.—Left lateral and dorsal views of apex of male abdomen. Drawings by C. H. Kennedy.

apically on each segment into black which occupies one-fifth to one-sixth of each segment, narrow, medianly interrupted basal blue rings; 7 black, narrow, medianly interrupted basal and subapical pale rings; 8 and 9 bright sky blue; 10 black, more or less pale yellow or bluish near the middle on either side of the median line. In a few very adult specimens 6 is like 7 and the dorsal brown of the preceding segments is much darker than in the larger number of specimens. Seen from the side, 1 and 2 blue with a narrow brown posterior border; 3 to 6 greenish, extreme lower border and over a wider area subapically, bright yellow, more or less obscured and indefinite in most of the dried material; 7 indistinct, apparently blue below the black dorsum; 8 and 9 blue; 10 with lower half blue, in some with the inferior apex yellow. Superior appendages black; inferiors yellow to black. Ventral suture black, paler and duller on the last three or four segments.

Legs light yellow, femora bluish or greenish tinged in some specimens; femora, especially the last 2 pairs, with a more or less distinct narrow dark line on the external angle.

Wings clear; stigma light brown to brown, encircled inside the enclosing veins with a narrow pale margin, covering one cell or slightly less, the inner side slightly more oblique than the outer, with a brace vein, the anterior and posterior sides longer than the other two sides.

♀.—Labrum light yellowish brown; rhinarium similar or darker or with greenish traces; nasus, frons and genae bright yellowish brown to obscure green. Head above as in the male, averaging paler, no trace of the dark bar on either side of the median ocellus, the pale dilatations on either end of the pale occipital crest larger and always dull orange. Rear of head cream-colored.

Prothorax variable as in the male, but the middle and hind lobes always brown, unmarked. Posterior border of hind lobe winged as in the male, but the middle lobe of the border is lower, apex truncated and sometimes slightly concave. Propleuron cream to light blue.

Dorsum of thorax similar to the male; sides similar but paler, sometimes almost white, in others cream or cream tinged with bluish, and so through intermediate stages to entirely pale blue; the brown spot on the second lateral suture scarcely evident in some specimens.

Abdominal segments 1 to 6 similar to the male, but the apical black is confined to a narrow apical ring; 7 and 8 orange brown, slightly darker along the median line, the darker color obscure, indefinite and narrow; 7 with a narrow interrupted bluish basal ring and a trace of an apical black ring; 9 and 10 light yellow brown, 10 sometimes with bluish traces. Pattern of abdomen often obscure; 7 to 10 often a uniform dull yellowish brown; in one specimen the dorsum of 6 is light metallic green instead of the usual brown. Seen from the side similar to the male, usually obscure especially the last four or five segments; in several cases 9 has a large distinct dark area; in other cases 9 and

10 are distinctly paler, light yellow, in the lower half; usually 7 to 10 are obscure brown or dull orange. Ventral suture as in the male. No trace of a vulvar spine.

Legs cream colored or very light brown, similar to the male, but the femoral stripes wanting or faintly represented on the last femora only.

Wings similar to the male.

British Guiana: Georgetown, January 25 and 26, and February 18, 1912, 19 ♂, and 7 ♀; Wismar, January 30, 1912, 1 ♂; *types,* a ♂ and ♀, January 26, in my collection.

In the Botanic Gardens at Georgetown in January, 1912, many of the pools were dried up and all canals and pools were at a very low water stage. Just a short distance from one of the main drives was a pool grown up with *Nelumbo,* into which pool a very small stream of water trickled. *Demararum* was along this thread of water for a short distance back from the pool, and about the pool near the mouth of the stream. Their flight was rather slow and heavy.

Specimens of this species were sent to Dr. Calvert and Dr. Ris for examination. Both regard it as undescribed. The following species, other than those here figured have been referred to *Leptagrion*: *inca* Selys, *inornatum* Selys, *obsoletum* Selys, *perlongum* Calvert, *rufum* Selys. *Inca* is known from an imperfect ♂ and 2 ♀; *demararum* is distinct from it, among other characters, by the rear of the head entirely pale and by the absence of a post-humeral black band. *Inornatum* is known from a single ♀; *demararum* is distinct from it, among other characters, by the very different stigma, by having the labrum and rhinarium not shining black, and by the thorax having a middorsal dark stripe. *Obsoletum* is known from a single ♂ and ♀; *demararum* is distinct from it, among other characters, by the color of the vertex, and of segments 7-10 of the ♂, and by the form of the ♂ appendages. *Perlongum* is known from a single ♂, supposedly close to *porrectum,* and having the abdomen 64 mm. in length, more than twice the length of *demararum. Rufum* is known from a single ♂ lacking the last 4 abdominal segments; *demararum* is distinct from it, among other characters, by the almost totally red coloration of head, thorax and abdomen of *rufum.*

Aeolagrion dorsale Burmeister. (Type of the genus). (Plate XVII, figs. 5 and 6; Plate XVIII, fig. 21).

Abdomen ♂ 27-30, average 28.3, ♀ 27-28; hind wing ♂ 17-19, average 17.7, ♀ 18-19.

♂.—Genae light bluish green, very pale, to bright bluish green; labrum brown to shining black; rhinarium and nasus bluish green, light and bright in older specimens, the nasus with a little dark or black at base; frons in front bluish green below on the lateral margins, remainder orange or rust brown to dark reddish brown and, in extreme cases, black. Head above metallic green to black, a short orange line from the lateral ocellus outward and forward toward the antenna, reaching a little more than half the distance. Rear of head upper half black, lower half very pale bluish to pale greenish.

Prothorax with the front lobe blue, broadly black posteriorly but not reaching the lateral margins; middle lobe blue, black above, narrow anteriorly, widening rapidly posteriorly where it occupies the full width of the lobe; hind lobe black dorsally with a continuation of the middorsal thoracic stripe, sides blue. Hind lobe laterally winged, the median portion greatly developed in a dorsally directed triangular plate, more than twice as high as the wings, the apex acute, the sides convex. Propleuron pale, bluish above to entirely blue. In very mature specimens the blue of the prothorax is more or less overlaid with silvery white.

Dorsum of thorax its entire length broadly metallic green to black, the stripe gradually narrowed at either end, bordered on either side by a blue stripe, scarcely half as wide, which reaches the humeral suture; a narrow brown or black posthumeral stripe which is continued across the mesinfraepisternum and which shades out into the rust red which occupies practically all of the mesepimeron; with age the mesepimeron darkens till, in extreme cases, it is entirely black except an anterior superior blue spot and a small posterior inferior area which remains rust red; metepisternum and metepimeron very light blue to bright blue, sometimes an indistinct dark area on the metepisternum along the second lateral suture. Beneath and coxae white to pale bluish; coxae externally in older specimens bright to dark blue. The antehumeral blue stripe is sometimes more or less overlaid with silvery white and the same is true to a lesser extent of the blue of the sides of the thorax.

Abdomen from above black, slightly paler on 3 and 4 in younger individuals; a narrow apical blue ring on 1, and narrow interrupted basal blue rings on 3 to 7, yellowish on 7, and on all segments in younger individuals; 8 and 9 bright blue, 10 black. Seen from the side, 1 and 2 blue with a narrow dark apical border; 3 to 6, or 3 to 7 in younger specimens, with sides below yellowish or greenish, connected with the basal rings, and slightly widening subapically, the black of the

dorsum completely encircling the apex of each segment; in older specimens 7 seems entirely black; 8 to 9 blue; 10 black, slightly or distinctly paler below: Appendages black, in younger specimens the inferior dilatation of the superiors and the base of the inferiors brown; the inner surface of the superiors with a large shallow excavation which is densely clothed with long, soft, very light dull yellow hair. Ventral suture yellowish or brown, darker on 6 and 7.

Legs dull pale yellow or light brown; posterior external face and apex of femora black; tibiae with a very narrow dark line on the anterior external face, sometimes wanting.

Wings rarely clear, usually slightly tinged with brown; stigma dark brown to black, encircled or not within the enclosing veins with pale, rarely covering one cell, usually slightly less, shaped as in *demararum*. In a male from Cumuto, in both front wings, the anterior side of the quadrangle is distinctly longer than the proximal side.

♀—Genae pale, yellowish or bluish; labrum brown, sometimes somewhat darkened over much of its area; rhinarium and nasus dull bluish; frons in front as in the paler males. Head above as in the male, except that the frons anteriorly is edged with reddish brown, or, in a teneral specimen, is largely this color. Rear of head as in the male.

Prothorax in pattern similar to the male; front lobe slightly duller, rust red replacing black on the middle lobe, and brown replacing black on the hind lobe. Hind border with the lateral wings of the male greatly reduced, scarcely evident, passing directly into the high, almost semicircular middle part. Propleuron cream to light bluish.

Thorax similar to the male; the narrow posthumeral brown stripe wanting or indistinct; the mesepimeron not becoming black; the dark area on the metepisternum along the second lateral suture usually distinct and rust red in color, sometimes very distinct and occupying nearly one-half the sclerite. Beneath and coxae as in the male, but the coxae never showing more than a trace of bluish. Silvery white over blue areas never as conspicuous as in the male.

Abdomen seen from above similar to the male, except that 8 to 10 are black, very narrowly pale at apex. Seen from the side similar to the male, but the lower pale areas on 3 to 7 wider, of uniform width, not dilated subapically; 8 to 10 similar to the preceding segments, the lower pale area becoming progressively narrower posteriorly, and being continuous along the sides, reaching the apex of each segment. Ventral suture darker than in the male, largely dark brown to black on 3 to 6. Vulvar spine wanting.

Legs light yellow, a narrow line on the external angle and the apex of the femora, black.

Wings very slightly tinged with brownish; stigma light brown, pale-encircled within the enclosing veins, covering rarely one cell, usually very slightly less, shaped as in the male.

Dutch Guiana: Paramaribo, February 23, 1912, 49 ♂, 4 ♀. Trinidad: Cumuto, March 8 and 10, 1912, 4 ♂, 1 ♀.

Back of the rifle range at Paramaribo is a shallow ditch or mud-bedded stream which, on February 23, 1912, seemed entirely dry. However, I followed it for some distance and eventually discovered a few shallow pools of stagnant water. Near one of these pools and in the bed of the ditch lay a large log which for a short distance was a foot or more off the ground; dense grass grew about the log and thus a little room or cave was formed under the log, the log itself being the roof, the nearly dry mud the floor and the rank grass the sides. At one corner of this little room the grass was wanting, thus affording an open doorway. About this doorway and just within the little room no less than 50 *Aeolagrion dorsale* were taken. When I first discovered them possibly a dozen or twenty were in view, practically all of them well back under the log. At each stroke of the net, those not captured disappeared but in a moment they would be detected again, one here, one there, resting in the grass about the log. *Dorsale* is an inconspicuous species and is easily overlooked in grass. In adjoining woodland I caught two or three about the top of a large fallen tree. I have no notes and recall nothing of the Cumuto specimens which were taken at the little swamp where we took the large number of *Metaleptobasis* (Proc. U. S. Nat. Mus. Vol. 48, May, 1915, p. 601).

Aeolagrion flammeum Selys. (Plate XVII, figs. 13, 14; Pl. XVIII, 20).

Abdomen ♂ 32-35, average 33.2, ♀ 32; hind wing ♂ 21-22, ♀ 22-22.5.

♂.—Genae pale yellowish to pale bluish; labrum slaty blue to bright greenish blue; rhinarium slaty blue to light brown; nasus to ocelli dull orange or rust red. Head above black and dull orange; ocelli surrounded with black, except the median in front; on either side of the median is a short lateral black spur, not always distinct; from each lateral ocellus a black stripe runs forward and outward to meet a wide black area lying against the eye, and reaching inward to the level of the inner side of the second joint of the antenna; anteriorly it extends to in front of the antenna and posteriorly it is carried back over the rear of the head; it is often dark green in color and is always less intense black than the stripe from the lateral ocellus to the

eye. Occipital crest and adjoining area pale, this pale area running forward in a sharp point between the lateral ocelli. The pale area just in front of the stripe from the lateral ocellus to the eye, adjoining the lateral ocellus, is usually bright yellow, paler than the dull orange of other parts. Rear of head largely black, pale below and adjoining the foramen.

Prothorax orange red; the anterior border narrowly indistinctly brown, elsewhere slight, scarcely discernible traces of darker. Posterior border of hind lobe broad and high, rounded, medianly broadly emarginate. Propleuron similar in color to the pronotum, darker below.

Thorax above vivid rust red; mesepisternum with a longitudinal median stripe about one-third the width of the sclerite, which in dried material is scarcely evident or is indicated by a dull greenish or brownish stripe, which in life is a vivid light greenish blue, in striking contrast to the surrounding red. Sides paler rust red, especially below and behind; starting just behind the humeral suture and near its upper end, a broad stripe runs directly down across sclerites to end on the third coxae; this stripe is like the stripe on the mesepisternum, evanescent, and in dried material is variously indicated; in life it is a vivid greenish blue area, becoming yellowish on the metinfraepisternum, which appears to have been haphazardly placed on the insect by an artist who carelessly disregarded the boundaries of the sclerites; behind this stripe and parallel to it is a large pale yellowish area of indefinite extent which occupies the metepimeron, except its upper and lower ends, and extends above onto the metepisternum. Beneath and coxae cream-colored.

Abdomen light brown above becoming progressively darker from 1-6; 3-7 more or less distinctly narrowly pale at base; 3-5 black at apex; 3-6 with a trace of a longitudinal middorsal line, scarcely or not discernible on 3 and 4, plainer on 5 and 6; 6 black except at base as noted; 7 subbasally black for one-fifth to one-half its length, the black shading out posteriorly to yellow or orange; 8-10 yellow or orange with much scattered bright red pigment in dried material. Seen from the side 1 and 2 largely yellowish with some basal and apical blue or green traces, the posterior border of each narrowly brown; sides below of 3-6 pale yellow, narrowest and not always evident on 6; on each segment this pale color connected with the pale basal rings, but not reaching the apex, being terminated posteriorly by the apical black which encircles each segment; 7 broadly pale below the dorsal basal black, this pale shading out posteriorly into the pale area which occupies the entire apical portion of the segment; 8-10 entirely yellow or bright red. Superior appendages brown, inner and ventral surfaces more or less red; inferiors yellowish red at base, shading out into bright red, the extreme apex brown tipped. Ventral suture pale, about color of adjoining parts, in some cases darker on 6 and 7.

VENATIONAL CHARACTERS, EXPRESSED IN PERCENTAGES, OF SPECIES OF *Leptagrion* AND *Aeolagrion*, BASED ON THE FOLLOWING MATERIAL: *Leptagrion macrurum*, 2♂, *L. andromache*, 2♂, *Aeolagrion flammeum*, 5♂, 2♀, *Ae. dorsale*, 5♂, 5♀, *Ae. demararum*, 5♂, 5♀.

	Leptagrion macrurum	*Leptagrion andromache*	*Aeolagrion flammeum*	*Aeolagrion dorsale*	*Aeolagrion demararum*
Quadrilateral in front wing with anterior side equalling about one-half the proximal side	.....	.....	.....	male 30	male 30
about two-thirds—do	male 50	.....	male 90	female 10 male 30	..... male 60
anterior side very slightly shorter than proximal side	"	male 50	male 10	female 50 male 40	female 40 male 10
anterior side slightly longer—do	.....	.....	female 100	female 40	female 60
Quadrilateral in hind wing with anterior side equalling about one and one-fourth the proximal side	male 50	.....	male 10	male 20	male 90
about one and one-half—do	"	male 100	male 80	male 60	female 80 male 10
about one and three-fourths-do	.....	.....	male 10	female 100	female 20 .....
about twice—do	.....	.....	female 100	male 20	.....
Cubito-anal cross-vein in front wing distal to first antenodal about one-fourth the second antenodal costal space	male 50	.....	.....	male 40	.....
about one-third—do	"	male 50	.....	female 60 male 60	..... male 90
nearly or about one-half—do	.....	"	.....	female 40 male 60	female 100 male 10
slightly more than one-half	.....	.....	female 100 male 40	.....	.....
Cubito-anal cross-vein in hind wing distal to first antenodal about one-fourth the second antenodal costal space	.....	.....	.....	female 30	.....
about one-third—do	male 50	.....	.....	male 40	male 40
about one-half—do	"	male 50	.....	female 50 male 60	female 70 male 60
more than one-half—do	.....	"	female 50 male 60	female 20	female 30 .....
about two-thirds—do	.....	.....	female 50	.....	.....
A in front wing proximal to cubito-anal crossvein about one-half the length of the latter	.....	.....	male 80 male 40	.....	.....
slightly proximal to cubito-anal cross-vein	.....	male 50	female 100 male 20	.....	....
	.....	.....	.....	.....	female 20

A in front wing at the cubito-anal cross-vein	male 50	male 50			male 50
					female 40
slightly distal	"			male 40	male 50
				female 20	female 40
distal about or nearly the length of the cubito-anal crossvein				male 60	
				female 80	
A in hind wing proximal to cubito-anal crossvein about one-half the length of the latter			female 50		
slightly proximal to cubito-anal crossvein			male 50		
					female 20
at the cubito-anal cross-vein	male 50	male 100	male 50		male 40
			female 50	female 10	female 20
slightly distal	"			male 60	male 60
				female 50	female 60
distal about or nearly the length of the cubito-anal crossvein				male 40	
				female 40	
M_2 in front wing arising at or near the fifth postnodal				male 90	male 100
				female 100	female 100
midway between fifth and sixth				male 10	
at or near the sixth		male 50	male 10		
at or near the seventh	male 25	male 50	male 90		
			female 100		
at or near the eighth	male 75				
M_2 in hind wing arising at or near the fourth postnodal				male 80	male 100
				female 90	female 100
midway between fourth and fifth				female 10	
at or near the fifth		male 50	male 10	male 20	
midway between fifth and sixth			"		
at or near the sixth	male 25	male 50	male 80		
			female 100		
at or near the seventh	male 50				
at or near the eighth	male 25				
M_1a in front wing arising at the eighth postnodal				male 30	male 20
				female 30	
ninth		male 50	male 30	male 60	male 80
				female 70	female 80
tenth	male 50	male 50	male 60	male 10	
			female 75		female 20
eleventh	male 25		male 10		
			female 25		
twelfth	male 25				
M_1a in hind wing arising at the seventh postnodal					male 10
eighth				male 80	male 60
				female 90	female 30
ninth	male 50	male 50	male 50	male 20	male 30
				female 10	female 70
tenth	male 25	male 50	male 50		
eleventh			female 100		
	"				

Legs light yellow or light yellowish brown; external posterior surface of femora black, apex black or brown.

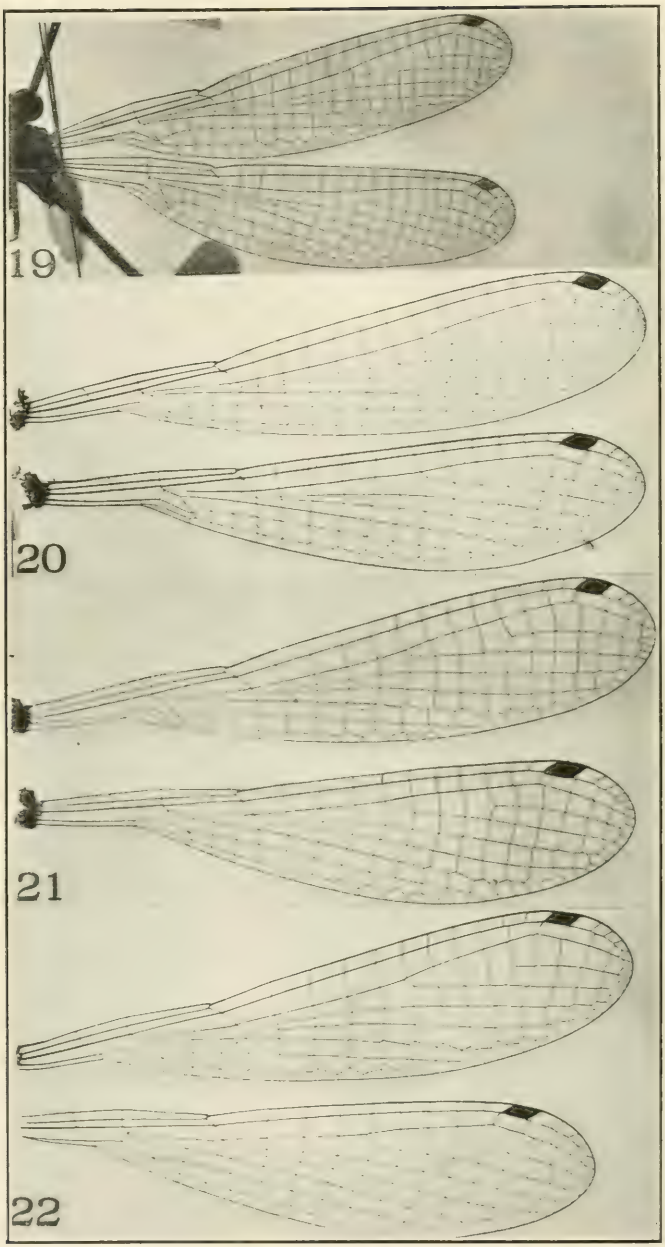
Wings clear to slightly brownish-tinged; stigma brown to reddish brown, encircled with pale within the enclosing veins, covering one cell or very slightly less, very slightly oblique, a brace vein present, the costal and posterior sides distinctly longer than the proximal and distal sides.

♀.—Similar to the male throughout except as noted, as brightly colored, at least in dried material; abdominal segments 7-10, seen from above, black, 10 with apex more or less red; seen from the sides 7-9 are pale below like the preceding segments, and 10 is largely pale with traces of red apically. Vulvar spine wanting.

British Guiana: Rockstone, February 12 and 14, 1912, 5 ♂, 2 ♀; Tumatumari. February 29, 1912, A. F. Porter, 1 ♂.

Three of the males taken at Rockstone were collected by my father and I know nothing of the circumstances as I was at Tumatumari at the time. But on February 14 we went together in the afternoon to the large island in the Essequibo opposite Rockstone. At this time the country was experiencing an unusual drought, the river was at a lower stage than many persons had ever before seen it, and we found the pools on the island dried up and dragonflies scarce. The four specimens of *flammeum* taken were found singly in the woods, in bushes or small trees, resting on the leaves at a height of 6 to 8 feet. .

When the above description was prepared and when the manuscript of this paper was sent to Doctor Calvert, I regarded *flammeum* as not congeneric with the species grouped under *Aeolagrion*. Doctor Calvert wrote me that he regarded my distinctions as very fine splitting; and later, in answer to my enquiry, Mr. Kennedy wrote me: "The penes of *flammeum* and *dorsale* are more alike than any other two species in the genus. There are slight differences but these are not generic unless there are good parallel characters in venation or elsewhere." I therefore follow the judgment of these two students in this paper. The key in this paper indicates the characters upon which I was basing my opinion on the generic distinctness of *flammeum*.



WINGS OF LEPTAGRION AND AEOLAGRION.—WILLIAMSON.

19.—L. MACRURUM.
20.—AE. FLAMMEUM.
21.—AE. DORSALE.
22.—AE. DEMARARUM.

Explanation of Plates.

Plate XVII. Appendages of males.

Figs. 1-14 by M. Menger from specimens in de Selys collection; figs. 15-16 from Mr. Samuel Henshaw, specimen in Hagen collection. Figs. 5 and 6 have been compared by Mr. Emerton with the type of *dorsale* in the Hagen collection and he reports them identical.

1, 2. *Leptagrion macrurum.*
3, 4. *Leptagrion andromache.*
5, 6. *Aeolagrion dorsale.*
7, 8. *Leptagrion porrectum.*
9, 10. *Leptagrion elongatum.*
11, 12. *Leptagrion dispar.*
13, 14. *Aeolagrion flammeum.*
15, 16. *Leptagrion (?) croceum.*

Plate XVIII. Wing photos.

Fig 19. *Leptagrion macrurum.* Photo. by C. H. Kennedy of a specimen in Dr. Calvert's collection.

Fig. 20. *Aeolagrion flammeum,* ♂, Tumatumari, British Guiana, February 29, 1912. Photo. by Mr. Munz.

Fig. 21. *Aeolagrion dorsale,* ♂, Paramaribo, Dutch Guiana, February 23, 1912. Photo. by Mr. Munz.

Fig. 22. *Aeolagrion demararum,* ♂, Georgetown, British Guiana, January 25, 1912. Photo. by Mr. Munz.

New Chalcid Flies from Maryland, II (Hym.).*

By A. A. Girault, Glenndale, Maryland.

Neomphaloidella mediogutta n. sp.

♀.—Length, 1.45 mm. Like *Aprostocetus whitmani* Girault, in general.

Dark metallic purple, the wings hyaline, the following parts golden yellow (legs darker yellow): Scape except the bulla and above narrowly, ring-joints, legs except the cephalic coxa laterad at base, the cephalic and middle femora dorsad for proximal two-thirds, proximal half of abdomen laterad and ventrad and the proximal third of same dorsad except for a narrow line across base, an abbreviated marginal stripe (which extends from near the apex of the yellow proximad to a little proximad of the middle) and a round median spot (opposite and between the marginal stripes, its diameter not as long as this stripe and which is not quite at the apex of the dorsal yellow—when the abdomen is retracted against the purple as is the marginal stripe).

Pedicel nearly twice longer than wide, a little shorter than club 1; funicles 1 to 3 subequal or a little shorter in succession, nearly four times longer than wide (joint 1), the club joints about twice longer than wide (but 3 shorter and conical, its terminal spine distinct). Mandibles tridentate. Sculpture usual, the propodeum scaly, with a median

*See Ent. News, xxviii, p. 20. Jan., 1917.

carina, no true lateral but a nearly straight, narrow carina just laterad of the elliptical spiracle. A single seta on scutum disto-laterad; a line of weak setae across pronotum caudad.

From two females, Glenndale, Maryland. From the woods by sweeping, margin of streamlet, July 12, 1916.

Types: Catalogue No. 20372, United States National Museum, two females on a tag, the head on a slide.

Eupelmus 2-guttus n. sp.

♀.—Length 1.65 mm., excluding the ovipositor which is extruded for nearly half the length of the abdomen.

Dark metallic green, the wings hyaline, the proximal third of the abdomen laterad and ventrad, the scape except its dorsal edge, the tarsi, the trochanters, knees, apex of cephalic tibiae, middle legs except a dot dorsad on tibia a short distance ventrad of knee, and a cinctus on the femur just proximad of the knee, caudal leg except the proximal half of the coxa and the tibiae at proximal fourth dorsad, brownish yellow.

Body finely scaly, the face in front of the cephalic ocellus opaque but smooth. Segment 2 of abdomen slightly incised caudad at meson, the others not so. Antenna inserted at the clypeus, the scape a little compressed; funicle 1 ring-like, a little wider than long, 2 and 3 subequal, about twice longer than wide, 4 slightly longer than either, a little longer than the pedicel, 7 and 8 quadrate; club 3-jointed. Fore wings rather slender, the postmarginal vein distinctly longer than the stigmal.

Glenndale, Maryland. One female by sweeping waste places in a garden, July 2, 1916.

Type: Catalogue No. 20365, U. S. N. M., the female on a tag, an antenna on a slide.

Sceptrophorus marilandicus n. sp.

♀.—Of the same stature and so forth as *solus* (Howard), but somewhat smaller and less robust, the basal fourth of the abdomen above (somewhat more below) is pale yellowish except a dot at each margin at base, the scape is wholly pale yellow, the hind tibia bears a metallic spot, a short distance below the knee, and the fore wings have the apex widely infuscated, the infuscation extending conically proximad to opposite the apex of the stigmal vein. Also the tegulae are half pale (basal half), the frons is slightly narrower and lacks the four rows of minute pin-punctures present on the other (or they are very obscure), the mandibles are smaller, their third tooth not so obtuse at apex, subacute, (truncate in the other but not *very* broad), the funicle joints are all shorter, the first subequal to the pedicel (6 quadrate),

there is a large, yellow stain under distal submarginal and all of the marginal veins, the postmarginal vein is slightly longer than the stigmal instead of being shorter; it is subequal to the marginal which is somewhat over thrice longer than wide. Types compared.

Head and thorax finely scaly, the scutum noticeably hairy; the axillae joined or nearly so. Head a little longer than wide, subtruncate at the mouth, the scrobes short, forming a triangle, the frons not prominent, the face inflexed but not greatly. Mandibular teeth subequal, acute. Ovipositor free, very slightly extruded. Eyes somewhat longer than the cheeks. Flagellum long, filiform-clavate, about twice the length of the club which is but slightly enlarged, its third joint longest, subequal to funicle 2. Propodeum glabrous, plane, transverse, shorter at the meson, the spiracle small, oval.

One female, Glenndale, Maryland. Open woods, by sweeping, September, 1916.

Type: Catalogue No. 20637, U. S. National Museum, a female on a tag, the head, a hind tibia and a fore wing on a slide.

BLATTOTETRASTICHUS new genus.

Based on *Entedon hagenowi* Ratzeburg (equals *Tetrastichodes floridanus* Ashmead) and differs from *Ceratotetrastichodes* in bearing but three ring-joints and the antennae are inserted below the middle of the face while the male antennae bear four funicle, three club and two ring-joints. The metallic coloration, white legs (except the first pair of coxae), pale yellow scape, pedicel, ring-joints and abdominal petiole and the fact that the scutum bears scattered, setigerous punctures and the pedicel and funicle 1 are elongate, are characters which make the species easy to be known. The specimens of it seen by me were from the eggs of domestic cockroaches from Louisiana and agree with Ratzeburg's short description: "Die Vorderhüften grössentheils dunkel;" otherwise as in *Eulophus xanthopus* Nees (as to coloration).

Genotype: *B. hagenowi* Ratz., a cosmopolitan species.

The following new species was labelled as the above species, in the collections of the U. S. National Museum:

Epomphaloides ischnopterae new species.

♀. A little less stout than *hagenowi* and black, the legs white, the funicle joints somewhat shorter; scutum with sparse punctures along its lateral margin only; mandibles with but two teeth, 2 broad and truncate at apex; male scape much shorter, much dilated, funicle 1 shorter than the other funicle joints. Otherwise the same.

From a large number of females and several males reared from the eggs of *Ischnoptera,* Plummer's Island, Maryland (E. A. Schwarz).

Types: Catalogue *No.* 20932, U. S. National Museum, one male, three females on tags, the antennae of each sex on a slide.

A new Species of Corythuca from the Northwest (Heterop., Tingitidae).

By Edmund H. Gibson, U. S. Bureau of Entomology, Washington, D. C.

During the past January the writer received from Mr. E. J. Newcomer, of the Bureau of Entomology, stationed at Wenatchee, Washington, specimens of what proves to be a new species of *Corythuca.* They were collected by Mr. Newcomer from prarie sunflower, *Balsamorhiza sagittata* Pursh, the type locality of which is known to be dry barren hills in the Rocky Mountains and its range from British Columbia and Montana to California and Colorado.

Corythuca pura n. sp.

Antennae with few long hairs, first segment about twice the length of second, fourth incrassated at the middle. Rostral groove prominent and rounded at the apex; rostrum reaching to middle coxae. Hood considerably raised, about one half as high as long, evenly reticulated and spined, median reticulation subprominent; rear of hood more or less concave, but distinctly globose. Membranous pronotal margins evenly reticulated and closely spined. Pronotum and base of triangular process punctate with apex reticulate. Triangular process bordered entire length with prominent membrane disappearing near apex. Median carina high and prominent with two rows of areolae, the top row not greatly reduced in size. Length 3.8 mm., width 2.5 mm.

Color, antennae ochraceous with apex slightly darker. Eyes black. Above entirely white, no spots of fuscous or color markings. Elytra subhyaline to opaque. Beneath entirely black, but with light brown legs. Beak same color as legs becoming darker towards apex.

This species is near *C. hispida* Uhl., but from which it may be separated by its larger size and by having the median carina of the pronotum higher and with two rows of large areolae and the margin of which is not so concave or curving.

Described from three females and one male which are deposited in the collection of the U. S. National Museum.

Studies on Costa Rican Odonata.

VIII. A New Genus Allied to Cora.

By Philip P. Calvert, University of Pennsylvania, Philadelphia, Pa.

In our recent book on Costa Rica* we have referred (page 255) to the capture, at Peralta, August 8, 1909, of "a medium-sized dragonfly, of an apparently new genus allied to *Cora*." Only a single male was obtained in spite of search in the same locality on following days in August and in March, 1910. The insect is evidently distinct from *Cora*, although the latter is its closest known ally. Mr. E. B. Williamson has very recently obtained a long series of the same genus, and possibly the same species, in Colombia, some specimens of which he has kindly sent me for examination, so that the recognition of this form as generically distinct seems thoroughly justified. The following account is based on the Costa Rican specimen, leaving to Mr. Williamson the future description of his Colombian material.

MIOCORA† new genus.

Possessing these characters of the legion Thore of Selys, viz.: Upper and lower sectors of the arculus (M1-3 and M4) separating from the upper (anterior) end of the arculus; proximal side of the quadrilateral much longer than the distal, its anterior (upper) side concave, costal and subcostal series of antenodals subequal in number but not coinciding in position in most cases; quadrilateral and median cell (M) cross-veined, the former shorter than the latter; and the following characters of the genus *Cora* Selys, viz.: M3 unbranched, no supplementary sectors between M4 and Cu1, and only one antenodal cross-vein (here the 8th or 9th, front wings, 9th or 10th, hind wings, of the costal series) thicker than the others.‡

*A Year of Costa Rican Natural History by Amelia Smith Calvert and Philip Powell Calvert, New York. The Macmillan Company, 1917.

†Greek μείων, less, and *Cora*, in allusion to the reduced venation in comparison with that genus.

‡In the Colombian specimens the thickened antenodal varies from the 9th to the 14th, front wings, 8th to 13th, hind wings.

Its distinctive differences from *Cora*, and indeed from the whole legion Thore of de Selys (1869), are the unbranched condition of Cu2, the presence of only a single row of cells between Cu1 and Cu2, and of only a single row between Cu2 and the hind margin of the wing.

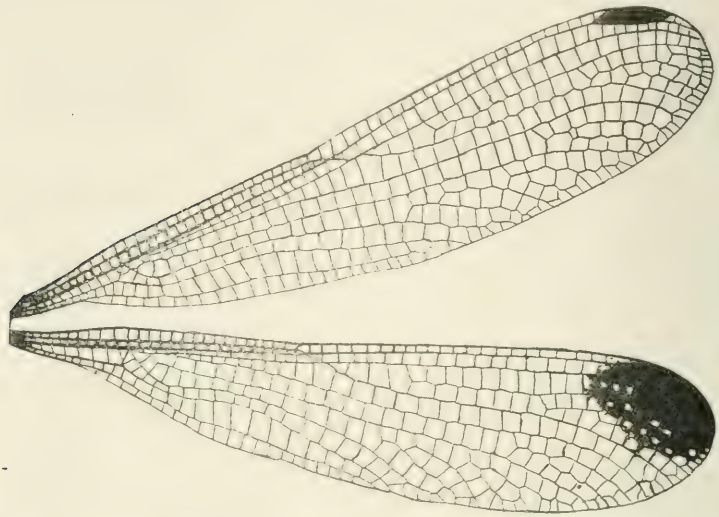


Fig. 1.—Venation of *Miocora peraltica* ♂, Peralta, Costa Rica, August 8, 1909. From photograph by Mr. H. A. Walters. See text for an explanation concerning the front wing.

The venation is displayed in the accompanying figure where, owing to the longitudinal folding of the front wing, M1-3 and M1-2 for a short distance distal to the separation of M3 is not shown as distinct from R, as it actually is in both front and hind wings, and as shown in our figure of the hind wing.

Genotype: *Miocora peraltica* n. sp.

Miocora peraltica n. sp. (Text figs. 1-4).

♂. Colors (as noted from the freshly caught specimens, some additional details not mentioned in the field notes but visible in the dried specimen being added in brackets [ ]): Eyes dark brown, below somewhat bluish. [Remainder of the head black, a short orange streak between each antenna and the median ocellus but nearer to the antenna], labrum, genae and external surfaces of the mandibles light blue, [cardines, stipites, submentum, mentum and basal two-thirds of median labial lobe pale luteous, probably also light blue in life.].

[Prothorax black, a pale blue? spot on each side of the middle lobe.]

Thoracic dorsum blackish; humeral suture, most of metepisternum and much of metepimeron pale bluish-green, but metepisternum and metepimeron each with an [oblique] blackish stripe, less than one-half as wide as the metepisternum but more than one-half as wide as the metepimeron. [Pectus pale bluish-green.]

Abdomen black, a spot on each side of segment 1, a longitudinal stripe on each side of 2 and a small basal spot on each side of 3, pale green.

Ventral surface of thorax pruinose and traces of pruinosity on ventral surfaces of abdominal segments.

[Legs: femora superiorly, tibiae inferiorly and tarsi blackish brown, femora inferiorly and tibiae superiorly pale, perhaps bluish in life.]

Superior appendages twice as long as abdominal segment 10, hardly as long as segment 9, black, in dorsal view forcipate, each becoming more slender to the apex which is acute and bent mesad at the extreme tip. Each appendage has a straight inferior process, projecting mesad, ventrad and caudad, best seen in oblique dorso-lateral view, and whose

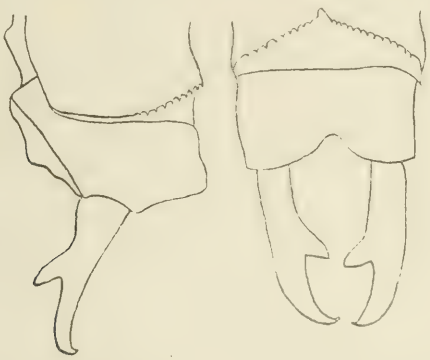


Fig. 2.—Left profile, Fig. 3.—Dorsal
Views of apex of abdomen of *Miocora peraltica* n. sp., type ♂.

proximal and distal edges separate from the inferior margin of the appendage at 5/14 and 8/14 of the latter's length respectively; distal edge of this process 3/14 of the length of the appendage; process becoming more slender toward its roundly acute apex. In profile view each appendage is directed caudad and ventrad as far as the last tenth of its length where its acute apex is curved dorsad; the appendage gradually decreases in thickness from base to apex, shows on its inferior margin a slight post basal convexity and the process described above, foreshortened at about mid-length. Inferior appendages not developed.

Front wings: 26 to 28 antenodals, 24 to 25 postnodals, 10 cross-veins in the median space, 3 cross-veins in the quadrilateral, pterostigma surmounting five cells and parts of one or two others, its proximal edge twice as long as its distal edge.

Hind wings: 25 to 22 antenodals, 24 to 26 postnodals, 8 to 9 cross-veins in the median space, 4 cross-veins in the quadrilateral, pterostigma surmounting four cells and parts of two others, its proximal edge 1.6 as long as its distal edge.*

All wings faintly smoky, costal and subcostal areas faintly yellowish from the base distad to beyond the nodus. Hind wings with an apical brown spot extending from about two cells proximal to the proximal end of the stigma to the wing-apex and from the costal margin to M_2, some cells between M_2 and R*s*, also being faintly brown, many of the cells within the area of the spot paler in their centers. Pterostigmata dark reddish brown.

Total length 42, abdomen 34, superior appendage 1.16, hind wing 24.5,

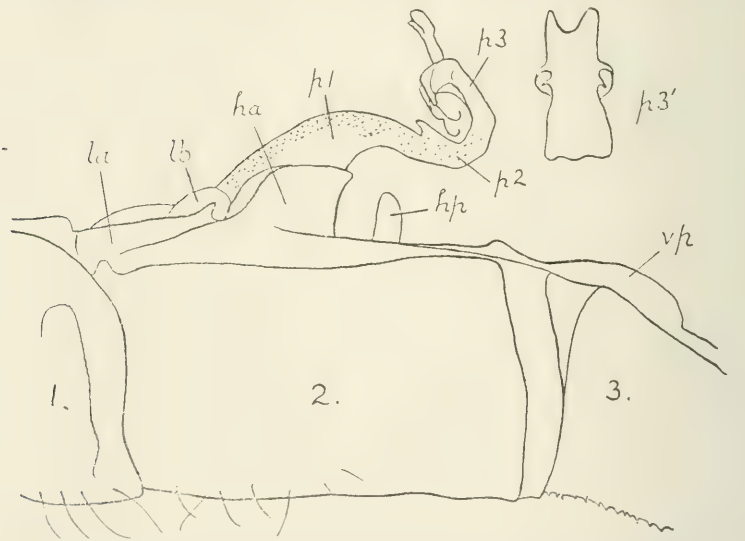


Fig. 4.—Genitalia of the basal abdominal segments, *Miocora peraltica*, n. sp., type ♂. The abdomen is viewed from the right side, ventral surface uppermost. 1, 2, 3, abdominal segments 1, 2 and 3; *ha*, *hp*, anterior and posterior hamules; *la*, anterior lamina; *lb*, lamina batilliformis of Rathke (1832) and Schmidt (1915), sheath of the penis of Rambur (1842) and of American authors; *p1*, *p2*, *p3*, first, second and third segments of the penis of Kennedy (1916); *p3'*, third segment in dorsal view; *vp*, vesicle of the penis ("Samenkapsel").

*As might be expected, the Colombian specimens show some variations in the numbers of these veins and surmounted cells in both front and hind wings.

costal edge of stigma of front wing 2, of hind wing 1.8, maximum width of front wing (mid-way between nodus and stigma) 5.5, same of hind wing, 5.5, width of head 4.8 mm.

Type a male from Peralta, Costa Rica, August 8, 1909, by P. P. Calvert, in the writer's collection at the Academy of Natural Sciences of Philadelphia.

In August, 1909, a short distance back of Peralta Station of the Costa Rica Railway, altitude 322 meters, 1055 feet, there extended a Y-shaped track to enable locomotives to reverse their heading. At the end of the stem of the Y was a narrow, slow-moving stream called simply "laguna." Just beyond the laguna was a low woods consisting of small trees, arums, ferns, heliconias and numerous vines or creepers. Here the type of *Miocora peraltica* was taken about noon.

The generic name *Thore* Selys, 1853, from which his legion Thore takes its appellation, was preoccupied by the name *Thore* applied to a subgenus of Attid spiders by C. L. Koch (Übersicht des Arachnidensystems, 5tes Heft, p. 66, Nürnberg, 1850). I therefore propose the name **Polythore** for the Odonate genus in allusion to the denser venation of its members in comparison with other genera of the Selysian legion. The type of *Thore* was fixed by Kirby (Cat. Odon. 1890, p. 116) as *T. gigantea* Selys, so this species becomes the genotype of *Polythore*. The oldest generic name thus left in the legion is *Chalcopteryx* Selys, 1853.

The Knaus Collection of Coleoptera.

Mr. Warren Knaus (class of 1882, Kansas State Agricultural College) has donated to the Entomological Museum of the College, his valuable collection of Coleoptera. Ever since he was a student in the College, Mr. Knaus has spent practically all of his spare time and vacations in collecting and studying the Coleoptera. He has made many trips into the arid regions of Mexico, Arizona, Texas and New Mexico to collect insects. These trips have been productive of a great many new species. His collection contains a number of species that are only found in one or two museums in the world, and these were furnished by Mr. Knaus. His collection will be kept separate and will be known as the "Warren Knaus Collection."—George A. Dean, Manhattan, Kansas.

Two new Species of Macrophya (Hym.).*

By S. A. Rohwer, Specialist in Forest Hymenoptera, Bureau of Entomology, Washington, D. C.

In a recent number of *Entomological News* (1916, vol. 27, pp. 274-77) Phil Rau has described, in some detail, the dance of a species of *Macrophya*. Inasmuch as the species was undescribed it is desirable that it should be named so that the observation may be catalogued and made available. The species described as *raui* is the one referred to in the beginning of Mr. Rau's paper, and the species described as *simillima* is probably the species recorded as being captured later in the week. From the material at hand it is impossible to make this assertion positive as the individuals are not dated. Both of these species belong to *Macrophya* in the restricted sense.

Macrophya raui new species.

Macrophya sp. Rau. Ent. News, 1916, vol. 27, p. 274.

This species is closely allied to *punctata* MacGillivray and *propinqua* Harrington. From *propinqua* it may be separated by the spot on the hind tibiae, the mostly black clypeus and labrum, and poorly defined middle fovea; from *punctata* the shape and size of the postocellar area will serve to distinguish it.

Female: Length 8.5 mm. Anterior margin of the labrum truncate; the clypeus deeply, arcuately emarginate, lobes broadly rounded apically; middle and frontal foveae not well defined; antennal furrows complete; front punctured; postocellar area more than twice as wide as long, the sides curved, the surface with rather close, large punctures; postocellar line one-third shorter than the ocellocular line; vertex, except the posterior part, shining, impunctate; third antennal joint but little shorter than the fourth and fifth joints; scutum and prescutum shining with separate distinct punctures; scutellum closely punctured; scutellar appendage completely roughened; mesepisternum striato-punctate; metepimeron normal; third cubital cell subequal in length with the second; sheath narrow, rounded apically, convex below.

Black; labrum in the middle, two small spots on the clypeus, an inconspicuous spot on the mandible, two very small spots on the vertex, the posterior margin of the pronotum narrowly, the anterior margin of

*Contribution from the Branch of Forest Insects, Bureau of Entomology.

the tegulae, two small spots on the propodeum medianly, a line on the anterior and intermediate coxae, a spot on the posterior coxae, all the trochanters, the apices of the anterior femora beneath, the four anterior tibiae beneath, the four anterior tarsi except apices, a spot at the base of the hind tibiae and a curved mark near the middle, the dorsal surface, the dorsal basal part of the second and third joints of the hind tarsi, and the base of the fourth hind tarsus—white or yellowish white; wings subhyaline, venation dark brown, stigma slightly paler.

Male.—Length 7 mm. Except for the usual sexual characters the male agrees in structure with the female. The anterior half of the clypeus is white and the posterior portion of the pronotum shows only a faint indication of the white band. In some of the male paratypes the white band of the pronotum is as distinct as in the female.

St. Louis, Missouri. Described from three females and seven males collected in April, 1915, by Phil Rau and given his number 1518.

Type.—Cat. No. 20907, U. S. N. M.

Macrophya simillima new species.

This species is related to *alba* MacGillivray, but the short antennae and long postocellar line easily separate it from MacGillivray's species. In habitus it resembles more closely *xanthonota* Rohwer, but the black hind coxae of that species readily separate the two.

Female.—Length 7.5 mm. Anterior margin of the labrum truncate; anterior margin of the clypeus broadly, deeply, arcuately emarginate; the lobes narrow and rounded apically; middle and frontal foveae represented by glabrous spots; antennal furrows obsolete; front closely punctured; postocellar line subequal in length with the ocelloccipital line and one-fifth shorter than the ocellocular line; postocellar area with its anterior width but little greater than its length, much wider posteriorly, the surface with a few large, well defined punctures; the sides of the vertex shining, almost impunctate; antennae shorter than the head and thorax, the third joint subequal with the fourth and fifth; scutum and prescutum opaque, and with a number of irregular poorly defined punctures; scutellum shining, the sides with large, well defined punctures, the appendage opaque and with two or three large punctures; mesepisternum reticulate on a finely granular surface; mesepimeron slightly produced posteriorly, shining, impunctate except the dorsal posterior angle where it is finely granular; second cubital longer than the third on the radius, subequal on the cubitus.

Black; base of the labrum, clypeus except the anterior margin, line on the mesepisternum, posterior margins of the pronotum broadly,

tegulae, large spot on the scutellum, propodeum except the sides—white or yellowish white; legs yellow; the apices of the four anterior tibiae above, the anterior tarsi above, the apices of the middle tarsi, the apical half of the posterior femora, extreme base of the posterior tibiæ, the apex of the posterior tibiæ, extreme base and apex of the first joint of the hind tarsi and the apices of the second and following joints of the hind tarsi, black; calcaria of the hind tibiae black and the other tibiae pale; wings slightly yellowish hyaline, venation including the stigma dark brown.

Male.—Length 7 mm. In color the male differs from the female in the white labrum and in the entirely black hind tarsi; in structure it agrees except for the usual antigeny.

St. Louis, Missouri. Described from one female (Rau No. 1531) and one male (Rau No. 1533), collected in April, 1915, by Phil Rau. A male and female paratype also come from Lincoln, Nebraska, collected in May, 1902, by W. D. Pierce. A female paratype from Michigan and a female paratype from Ithaca, New York, have a brownish spot on the basal dorsal part of the four anterior femora.

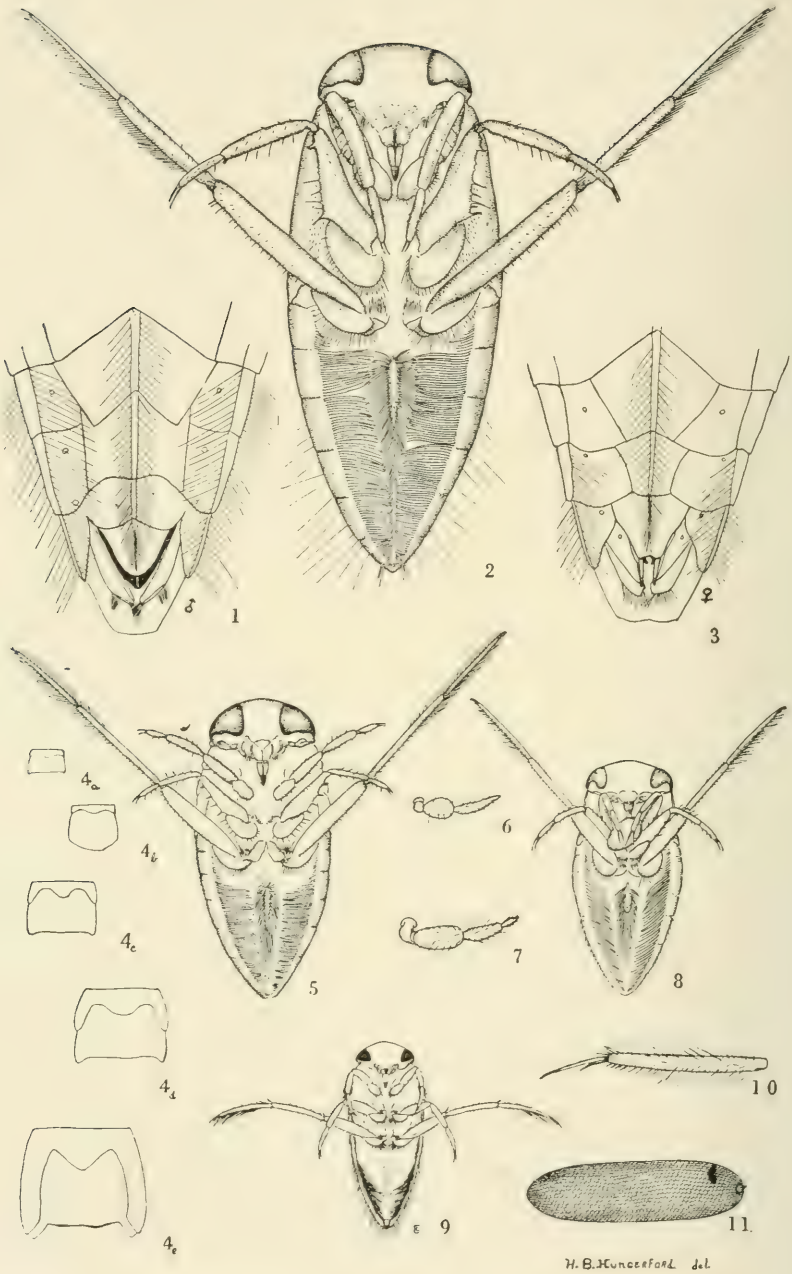
Type.—Cat. No. 20908, U. S. N. M.

Summer Work on Insects

Professor M. M. Ellis, of the University of Colorado, will conduct a course on the Natural History of Insects (elementary collegiate zoology being a prerequisite thereto) and will direct special or research work on insects at the Summer Session of the Biological Station of the University of Michigan, at Douglas Lake, Michigan, from July 2 to August 24, 1917.

Calopteryx dimidiata apicalis (Odon.).

In recently looking over some Odonata I found a damaged male of this species with the following data: "Dragonfly taken from canoe on Rancocas Creek three-quarters mile below New Lisbon, N[ew] [Jersey] Aug. 17, 1911, by S. N. Rhoads. About five males like this and as many females with less black were seen. Nowhere else seen. Always over water in shady places. A rare species there." Brown's Mills (also on the Rancocas) and Raccoon Creek are the only other records for the Delaware valley in the 1910 list of the Insects of New Jersey, so the recording of the present specimen is justifiable. The specimen has gone to Dr. R. Heber Howe, Jr., of Concord, Massachusetts.—PHILIP P. CALVERT.



NOTONECTA UNDULATA.—HUNGERFORD.

The Life History of the Backswimmer, Notonecta undulata Say (Hem., Het.).

By H. B. Hungerford, Cornell University.

(Plates XIX, XX.)

Of all our American water bugs none are more generally known in their native haunts than the Backswimmers. They are to be found in nearly every pool and pond and afford most interesting objects for aquarium study. The fact that they swim on their backs readily distinguishes them from all other water bugs.

The family Notonectidae, to which these bugs belong, is a small one, there being but three genera and a total of eighteen species reported for America north of Mexico. All but four species are assigned to the genus *Notonecta*, to which our commonest forms belong. These bugs are all of fair size (8-17 mm.) and for the most part marked with black and white or with black and various shades of red or brown. The various species of this genus may be distinguished by the table prepared for their identification by Mr. J. R. de la Torre Bueno (1905).

In New York State we find several interesting species in the same pool while in the ponds of Kansas the black and white *N. undulata* is the common and almost the only form taken in collecting. It is the life history of this species that this paper presents.

Literature.

So far as the writer has been able to find there is no account in the literature concerning the complete life history of any of the species of the genus *Notonecta* which are often dominant forms in our pools and ponds in America. Mr. J. R. de la Torre Bueno (1905) in his Notonecta of North America describes the egg of *Notonecta undulata* and records having reared them to the second or third instar when they died for want of proper food—he also presents some notes on the egg stage and number of nymphal instars of *N. variabilis*. Christine Essenberg (1915) describes the egg of *N. undulata* and gives a general account of the *Notonecta* egg, its incubation

and hatching, the behavior of the young nymph and the duration of the first nymphal instar. She did not carry them farther because of the difficulties involved.

In the literature dealing with the species in other lands, Kirkaldy (1897) in a footnote to his "Revision of the Notonectidae," stated his success in rearing to the third instar and regretted his inability to record the complete cycle, though he correctly surmised that there are five nymphal instars.

Delcourt (1907) gives brief reference to the number of instars and states that he reared *N. glauca* on mosquito wrigglers. This author was chiefly concerned with taxonomic problems as is shown by the title of his paper, "De la Necessité d'une Revision des Notonectes de France."

In 1911 D. Nowrojee gave the most complete account of the life history of any member of the subfamily *Notonectinae*. His paper deals with *Enithares indica* Fab. and is a two page account accompanied by four figures (egg, nymph, and adult) in color. A description of the egg, the length of incubation and the duration of the various instars are given.

Hoppe (1912) in his paper on "Die Atmung von Notonecta glauca" makes a few remarks on the life history, noting five nymphal instars.

On the other hand the behavior of these insects has been the subject of careful study on the part of a number of workers—especially in relation to respiration.

Brocher (1909, 1913) and Hoppe in Europe have made extended studies on the respiration of *Notonecta glauca* and Christine Essenberg (1915), of Berkeley, California, has written upon the behavior of four California species.

In addition to the above more important references, dealing with species of *Notonecta,* there are many interesting notes to be found in the text-books and scattered through the literature from an early date to the present time. Some of these will be noted in the body of this paper or listed in the Bibliography.

Habitat and Migration.

Notonecta undulata, besides being the most widely distributed form, seems to be able to adapt itself to a wider range

of circumstances than most of the others. The writer has taken it in clear spring-fed pools in New York and in the stagnant scum-covered waters of muddy ponds in Kansas. Uhler (1876) says "it inhabits the foulest pools, in dirty slush and slimy ponds it revels in full enjoyment of the filth."

Barber (1913), in a popular paper on Aquatic Hemiptera, makes a similar reference to its habitat. Thus it may be noted to be less sensitive than many others of its genus to its environment. When the small bodies of water recede during the prolonged period of dry weather, which we sometimes have in late summer in Kansas, it is among the last to take wing to more favorable situations, a fact which is not to be accounted for on the basis of weak powers of flight, for it does on occasion fly very well, as appears to have been noted for the European forms at an early date. Aldrovandus spoke of them as amphibious bees and Swammerdam, at the close of his discussion of the *Notonectae*, a name applied to them by Mouffet, 1634, makes the following interesting remark in regard to the migration of water bugs: "As all the insects hitherto enumerated have wings, some of them flying in the daytime and others at night, it is easy to conceive that they may be very speedily generated in all standing waters."

In the first warm days of spring, the writer has observed them coming by the dozens and alighting in a small road-side pool. Thus their range, which was restricted by the drouth of the previous fall, was again extended to the many favorable pools of spring and early summer. There are several records of Corixid migrations in this country but only one, so far as the writer knows, for *Notonecta*. In September, 1846, near the head waters of the Mississippi, S. G. Simpson reported a swarm of *"N. glauca,"* which extended over 25 or 35 miles. This species, if a Notonectid at all, was doubtless the common *N. undulata*.

Food and Food Habits.

The predatory tendencies and the daring attacks of these insects upon other animals of formidable size have been known from the first biological notes concerning them. Nearly every

writer has enlarged upon this point, but they also feed quite largely upon ostracods and similar organisms, especially in their younger stages as has been previously pointed out by the writer.* He began his attempts at rearing by using mosquito wrigglers as recommended by Delcourt, but met with indifferent success, perhaps because he did not secure them in proper sizes. It was soon discovered that ostracods made an excellent fare and afforded a constant supply. A large aquarium was teeming with them, from which they were transferred by means of a pipette to the small petri dishes in which the notonectid nymphs were isolated. It is interesting to watch the nymphs feed upon these little bivalves. The capture and consumption may be watched under the binocular with ease for the prey is held against the venter, which is upper-most as shown by the drawing, Pl. XIX, fig. 8.

The little notonectid is not prone to carry on an extended chase, doubtless aware that success is more surely attained by waiting until the prey comes within striking distance, than by sustained effort.

Thus it rests suspended from the surface film with the rowing legs poised well forward of right angles to the body, ready for a sudden attack. At last an unsuspecting ostracod comes gliding over the bottom of the petri below, a sudden dart, dodge and a turn and notonecta returns to its former position on its back, tip of the abdomen at the surface film and the body sloping head downward at its customary angle, but now embracing the luckless bivalve with both fore legs. With the armored prey, held prisoner upon the coxae of the fore legs, it turns it about to find a vulnerable point in which to jab its stylets—at last success is attained, the valves open and do not close again for the nymphal backswimmer feeds. Though partaking of the contents of this ostracod and both fore legs busy retaining perhaps as many as two others, gathered since the feeding began and which are striving to escape, this greedy fellow dives again and again at other ostracods that pass near by. Finally, having exhausted the supply of nutriment con-

*Science N. S. Vol. XLV, No. 1162, Page 336, April 6, 1917.

tained in the captured victims, their shells are cast aside and the process repeated as opportunity affords. A careful examination of the field notes brings to light the fact that at the time when *Notonecta* nymphs in their first and second instars were in their greatest numbers, both in their spring and summer generations, the waters were teeming with ostracods. In the laboratory nymphs have been carried through the first four stages on ostracods alone, but as a rule they were supplied nymphal corixids in the later instars. The corixids have been found very satisfactory for *Belostoma* nymphs also.

Adaptations to Aquatic Life.

Much has been written upon the adaptation of *Notonecta* to an aquatic life. Brocher (1909) places them with the Naucorids, midway between the less modified Corixids and the more greatly modified Nepids. He was considering the matter from the standpoint of respiration. Following some clever experiments, in which he removed certain air retaining devices of the body and closed, in turn, various spiracles, he concludes that they inspire through the last abdominal pair of spiracles and that the air retained about the body is for the most part expired air, liberated by the thoracic spiracles. Perhaps the first note in this country representing a close observation of the respiration appeared in the *American Naturalist* for 1887 and was written by Professor Comstock.

Oviposition.

A somewhat detailed account of the literature on the oviposition of these insects was given in the discussion and in an annotated bibliography accompanying the paper "The Egg Laying Habits of a Back Swimmer, *Buenoa margaritacea*," etc., by the writer (1917). In this paper it was noted that *Buenoa margaritacea* places its eggs in the stems of plants. It may be stated that though *N. undulata* may sometimes abrade the surface, as noted by Bueno, the chitinous processes of the ovipositor are ill adapted to making any such deep incision as are made by *B. margaritacea*.* Christine Essenberg (1915),

*On the other hand *N. irrorata* has a long ovipositor and inserts its eggs wholly or in part in the stems of submerged plants. The writer has had the opportunity just recently to study this species and finds the eggs laid in the aquaria placed in incisions of the stems of moneywort, etc.

in California, states that the four species with which she worked place their eggs on the stems. It is certainly the case with *Notonecta undulata* whose elongate white eggs may be found, in large numbers, on the dead stems of weeds lodged in the water or on any other support. Photographs of the eggs are shown in Plate XX, figs. 6. 3 and 4.

Seasonal Range.

The adults may be taken in Kansas any time during the winter when the waters are open enough to permit collecting. They pass the coldest portions of the year in the mud or among the rubbish and dead leaves in the pool. They can even spend as long a time as six weeks in damp piles of dead sticks, so it does not necessarily follow that they perish because the pools diminish during weather when they are but sluggishly active. During the season of 1916 egg laying began about the middle of March and continued till the end of April. The largest numbers were noted on April 11th. By the 4th of May, the first and second instar nymphs were in greatest abundance in all the pools under observation which were teeming at this time with ostracods. The 25th of May found many of the nymphs in the fifth instar and the adults were appearing in numbers June 1st. A few nymphs in the earlier instars were still to be noted, but no eggs had been found for some time.

On June 7th freshly laid eggs were again taken and they continued to be noted up to the first week in August. Many nymphs in their first stages were noted on July 13th and many of these reached the adult stage about August 20th. By this time the pools that had been chosen for the daily field observations were either completely gone or so greatly restricted that observations were transferred to the larger bodies of water.

In the laboratory rearings were made in stender and petri dishes—one bug to a dish. From these rearings it may be said that the eggs laid on March 18th hatched March 30th. Eggs laid April 12th showed the pink eye spots April 16th, and began hatching April 22nd.

The average time for each of the first four instars was 7

days, for the fifth instar 12 days. Eggs laid July 12th hatched July 17th, averaged 6 days for each of the first four instars and 11 days for the fifth—a total of 40 days from the deposition of the egg to the adult stage, a period somewhat shorter than for the spring generation.

Description of Developmental Stages.

The egg. A description of the egg of this species was given by Bueno (1905) as 1.9-2 mm. in length, clear glistening pearly white when recently deposited. Chorion sculptured in irregular hexagons. Shape elongate oval. A large series of freshly laid eggs averaged 1.75 mm. in length, varying from 1.625 mm. to 1.813 mm. The diameter ranged from .5 mm. to .6 mm. The shape of the egg is modified as the embryo develops. The embryo lies with its back to the attached side of the egg as a rule. After a few days incubation the eye spots begin to appear as faint pink blotches—darkening as development takes place till shortly before hatching the black hairs bordering the various portions of the body of the nymphs are visible through the chorion.

Hatching takes place upon bursting the cephalic end of the egg as shown in the photograph. The nymph comes forth swathed in a clear membrane, gradually working its way, by backward and forward movements, till it is nearly clear of the egg shell, whereupon the embryonic sheath splits and slowly the new bug frees itself, the swimming legs being the last to leave the shell. As the legs are freed they spring out into position. When at last the little bug is clear, it rests as though exhausted, then it makes, during the next fifteen or twenty minutes, intermittent endeavors to attain the surface. In these efforts it approaches the surface head uppermost and is heavier than the water—dropping to the bottom as soon as its struggles cease. Finally it may succeed in hooking a front claw into the surface film where it will hang suspended for some minutes. Finally it turns on its side, pierces the surface film, then darts below, the guard hairs closed over a bubble of air—up to this time the guard hairs of the abdomen have rested limp against the body.

In the light of Tillyard's work with hatching dragonfly nymphs and the work of Hoppe and Brocher on the respiration of older notonecta nymphs, careful and extended observations on the respiratory activity of the newly hatched water bugs are to be desired.

The Nymphal Instars.

First Instar. Size: see table below. Color: General body white, eyes red, hairs and spines black, antennae smoky black. When first hatched the abdomen especially transparent and the movements of the organs plainly visible within. Tarsal claws all conspicuously black.

Structural peculiarities. The most characteristic feature of the first instar is the absence of the tuft of hairs which in all succeeding instars is found on a median ventral carina of the abdomen. The eyes are relatively far apart. The antennae are apparently two-segmented and directed downward (really three segments). The tarsi are all one-segmented and end in two claws. The tarsi of the hind legs are fringed with hairs. The middle femora are furnished on their caudo-ventral margins with two strong bristles set upon elevations.

Second instar. The presence of the tuft and fringe of hairs on the ventral abdominal carina is the chief addition over that of the previous stage. The rear margin of the middle femora are now equipped with three strong bristles and there is a suggestion of the tooth or spine that becomes prominent in the succeeding instar. Antennae 3-segmented. First segment short, disc-like, second somewhat globose and third elongate.

Third instar. The caudal margin of the mesothoracic femur now carries a well developed tooth as well as the three stout spines noted

Table of Measurements.

Stage	General Measurements					Hind Leg			Middle Leg			Fore Leg		
	Length	Width	Width Head	Between Eyes	Syntil. to Vertex	Femur	Tibia	Tarsus	Femur	Tibia	Tarsus	Femur	Tibia	Tarsus
1st instar	2.125	1.062	.833	.43	.818	.687	.707	.875	.437	.437	.313	.37	.375	.275
2d instar	3.1	1.41	1.06	.395	.73	.975	.975	1.12	.63	.625	.437	.5	.53	.37
3d instar	4.66	2.	1.4	.4	.66	1.47	1.47	1.53	1.	1.	.65	.75	.762	.57
4th instar	6.125	2.75	1.87	.53	.66	2.125	2.	2.	1.38	1.37	.93	1.	1.12	.75
5th instar	8.5	3.5	2.5	.66	.582	3.1	2.89	2.75	2.1	2.	1.16	1.5	1.58	1.12
6th ♂	11.4	4.	2.86	.4	.4	4.1	3.48	2.86	2.68	2.57	1.43	1.94	2.28	1.26
6th ♀	11.4	4.28	2.97	.42	.41	4.28	3.54	2.97	2.85	2.68	1.66	2.	2.28	1.43

in the second instar. Tibia and tarsus of hind leg now fringed with hairs—wing pads as in Fig. 4*c*, Plate XIX.

Fourth instar. The middle femora now bear very stout processes in the line of the caudal row of spines. A series of short processes on the ventral side of this segment take the place of minute rugosities of the previous instar.

Fifth instar. The tooth or strong spine on the mesothoracic tibia is now extremely wide at its base. The limbs are stouter than previously and the wing pads now have the position shown in figure 4*e* of Plate XIX.

In the above table the measurements are in millimeters and based on reared material. The adults are certainly smaller than those taken in Ithaca, New York, though practically the same as specimens from nature in Kansas. These figures are intended to help in determining an instar. The series measured is not large enough for purposes of generalization.

General notes on development. There are certain constants of structure that are carried through all the nymphal instars. The mesothoracic legs may serve as an illustration of this point. In all the instars the tarsi end in unequal claws as in the adult, and the tibiae possess a row of five bristles on their caudo-ventral margin and the tarsi three such bristles.

The metathoracic tarsi end in an unequal pair of claws which are prominent in the first instar (Pl. XIX, fig. 10) and which become less and less conspicuous as development proceeds till in the adult stage their similarity to the other structures of the swimming leg has led to the common statement that the tarsal claws of hind legs are absent in the adult. Upon transforming to the adult stage the one-segmented condition of the tarsi is replaced by a two-segmented tarsus and the three-segmented antennae becomes four-segmented. (See Pl. XIX, figs. 6 and 7.)

The eyes occupy an increasingly large proportion of the head in successive instars, a point not properly indicated in the drawings which were made from living bugs in the water.

Summary.

Notonecta undulata is the most widely distributed of all our backswimmers. It lives well in the aquarium and may be reared from deposition of the egg to the adult stage in some forty days if placed in isolated jars and given proper attention. The young stages thrive on a diet of ostracods and the advanced nymphs do very well on immature and small corixids for a food supply. In Kansas there are two main broods in

a season, one reaching the adult stage in June, the other in August. Since these insects draw quite largely in their young stages upon the ostracods and similar organisms, which represent a chief food supply for young fish, as well as preying upon small fish directly, as has been noted several times, they deserve more careful study. This task is greatly facilitated by a workable key to the species and by some knowledge of their feeding habits.

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Explanation of Plates.

Plate XIX.

Fig. 1.—Ventral view of terminal abdominal segments of male *Notonecta undulata* Say.

Fig. 2.—Fifth instar nymph.

Fig. 3.—Ventral view of terminal abdominal segments of female.

Figs. 4*a* to 4*e*.—Diagrams of dorsal view of meso- and metathorax of nymphs, first to fifth instars respectively, showing the developing wing pads.

Fig. 5.—3rd instar nymph. Both rows of swimming hairs shown.

Fig. 6.—Antennae of 5th instar nymph.

Fig. 7.—Antennae of adult male.

Fig. 8.—2nd instar feeding upon an ostracod.

Fig. 9.—1st instar nymph—drawn by Miss Ellen Edmonson.

Fig. 10.—Tarsus of hind leg of first instar nymph showing the tarsal claws which become less conspicuous as development advances.

Fig. 11.—Egg of *Notonecta undulata*, showing details of structure, drawn by Miss Ellen Edmonson.

PLATE XX.

Fig. 1. Two eggs of *Notonecta undulata* after hatching, showing the characteristic slit in the shell and the clear embryonic membrane shed by the nymph upon emerging.

Fig. 2. Adult *Notonecta undulata* in the water.

Fig. 3. Egg nearly ready to hatch—note the red eye spot and the dark line at margin of the gelatinous substance which glues the egg to its support.

Fig. 4. A freshly laid egg viewed from above.

Fig. 5. A roadside pool in early spring. The backswimmers were arriving in numbers flying from some unknown quarters where they had passed the winter.

Fig. 6. Eggs of *Notonecta undulata* freshly laid upon old weed stems lodged in the waters of the pool. Gyrinid beetles lay somewhat similar eggs which may be distinguished by their arrangement upon their support and by the fact that the eye spots in advanced eggs are black instead of red and farther from the end of the egg than in those of the backswimmers.

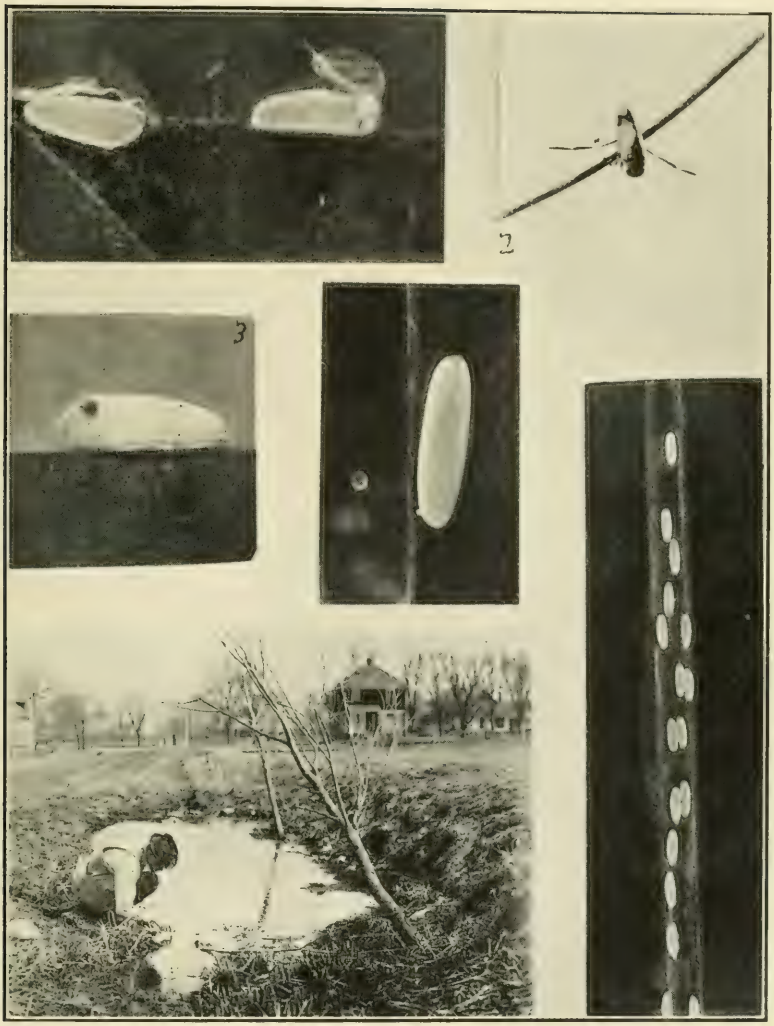
Seasonal Abundance of Flies in Montana (Dipt.).[1]

By R. R. PARKER, Bozeman, Montana.

During the season of 1914 the Montana State Board of Entomology started investigations to determine the life history and habits of the house fly (*Musca domestica* Linnaeus) and flies of similar habits common in Montana cities and towns and their relation to insanitary conditions. Investigations during 1914 were conducted mainly at Laurel and incidental observations were made at other points in the Yellowstone Valley during the same season. In 1915 the work was carried on at Miles City and the more important results have been presented in the *Journal of Economic Entomology* for June, 1916 (pp. 326-354). Observations incidental to other work have been made in various other localities.

The present paper concerns the seasonal abundance of flies, particularly the house fly, and the most important portion is based on work done at Laurel during July and August of 1914. This town had a population of about 1200, the houses were

[1]Contribution from the Laboratory of the Montana State Board of Entomology, State College, Bozeman, Montana.



NOTONECTA UNDULATA.—HUNGERFORD.

widely separated, the general conditions semi-rural and health conditions very poor. Several previous investigations have concerned the comparative abundance of flies indoors, but the work herein discussed dealt with out-of-doors conditions. Its principal object was to determine approximately the height of the house fly season in Montana. Five places were selected representing a variety of conditions and at each a single Hodge trap was placed out-of-doors. Two traps were placed at residences, at one of which there was a privy, at the other a stable; the third was placed in the rear of a meat and fish market; the fourth, in the rear of a general provision store, and the fifth near an old garbage hole in the rear of the laboratory. The traps were placed in exactly the same spot each day. Collections were made on five days of each week (except Saturday and Sunday) at eight o'clock in the morning. New traps were immediately substituted and the pans rebaited (with fresh beer). At the laboratory the flies were killed with ether and the number of each species recorded for each place of setting. A record was also kept of the noon temperature* and daily weather conditions. The weather records were found to be of no apparent significance.

The results of the experiment are given in the accompanying table, which shows that the house fly reached its greatest abundance (height of fly season) during the first three weeks in August and was present in abundance during the whole month.† It is interesting to note that the height of the house

*During the first week temperature records were taken at three in the afternoon which doubtless accounts for the fact that the average period temperature was higher for the first week than for the second as shown in the table.

†The decrease in the record for the second week in August was due to the fact that during the collecting period of that week, a pile of lumber was placed where the trap was usually set in the rear of the meat market. The results were materially affected because this was the point where most of the flies were captured. The record for this week (2266) shows a decrease of 8265 *Musca domestica* from the number captured at this place during the first week in August and a decrease of 9680 from the number captured the third week. A record corresponding to those of the first and third weeks would have brought the total for the second week well above 20,000.

fly season followed the period of highest average temperature the last week of July and was initiated by an abrupt increase in house flies the first week of August and ended with an abrupt decrease during the fourth week. In September temperature naturally decreases and is attended by a corresponding decrease in the numbers of adult flies. It is a common idea

TABLE SHOWING CATCH OF VARIOUS SPECIES OF FLIES BY WEEKLY PERIODS, AND AVERAGE PERIOD TEMPERATURES.

Dates of Collecting Periods	Average Period Temperature	*Musca domestica*	*Muscina stabulans*	*Muscina assimilis*	*Lucilia sericata*	*Lucilia caesar*	*Lucilia sylvarum*	*Phormia terraenovae*	*Phormia regina*	*Calliphora erythrocephala*	" *coloradensis*	" *latifrons*	*Fannia scalaris*	" *canicularis*	" *sp.*	*Ophyra leucostoma*	*Anthomyidae* undetermined	*Ravinia communis*	*Ravinia penicillata*	*Sarcophaga haemorrhoidalis*	*Sarcophaga cooleyi*	*Boettcheria cimbicis*	*Anacampta latiuscula*	*Culex tarsalis**
July 7-10	84.0°	2941	1174	10	763	28	10	19	46	57			563			2	....	10	...	1	....	....	2	....
July 13-17	80.8°	6276	926	6	229	44	2	5	38	31			488			4	1	2	4	....	....	1	1	....
July 20-24	86.0°	4892	315	....	36	13	....	....	15	4			109			2	2	1	3	....	....	....	1	....
July 27-31	91.8°	8979	331	1	115	4	2	....	21	11			108			4	....	1	....	....	4	....	....	1
Aug. 3-7	88.6°	20783	284	5	200	13	....	1	42	6			482			3	....	2	6	....	1	....	1	1
Aug. 10-14	82.6°	12088	147	5	31	....	1	....	24	5			189			....	....	3	....	1	1	....	....	....
Aug. 17-21	75.0°	19425	139	2	57	1	....	....	21	8			241			1	....	4	1	....	....	....	....	1
Aug. 24-28	70.0°	12861	157	5	25	....	....	....	37	1			114			2	2	13	....	3	1	....	....	6
Totals		88245	3473	34	1456	103	15	25	244	123			2294			18	5	36	14	5	7	1	5	9

in Montana that flies are most abundant in houses during September, though their number out-of-doors is materially less. Observations have also indicated that other species besides the house fly are more numerous in houses at this time. This is probably because a greater proportion of flies are impelled

* Determined by J. R. Parker.

to seek the warmth inside houses and to remain there for comparatively longer periods than earlier in the season. From this time on flies become fewer and fewer, though they are frequently seen in houses during warm spells as late as December. Observations made in a greenhouse at Bozeman during the winter of 1916 and 1917 indicate that the winter is sometimes passed by continuous breeding in warm places affording suitable conditions. It is probable that the flies also winter over in the pupal state. At Miles City (altitude 2200 ft.) house flies begin to be numerous early in May, later in cities in higher altitudes.

The house fly constituted 91.80 per cent. of the total catch (96,122). The numbers of each of the other species captured and the percentage of the total catch were as follows: *Muscina stabulans* (Fallen), 3473 (3.61); *M. assimilis* (Fallen), 34 (.03); *Lucilia sericata* (Meigen), 1456 (1.51); *L. caesar* Linnaeus, 103 (.09); *L. sylvarum* (Meigen), 15 (.025); *Phormia terraenovae* (Desvoidy), 25 (.03); *P. regina* (Meigen), 244 (.25); *Calliphora,* including *erythrocephala* (Meigen), *coloradensis* Hough and *latifrons* Hough, 123 (.13); *Fannia,* including *scalaris* (Fabricius), *canicularis* (Linnaeus) and an undetermined species, 2294 (2.38); *Ophyra leucostoma* Wiedemann, 18 (.02); undetermined *Anthomyidae,* 5 (.005); *Ravinia communis* R. Parker, 36 (.04); *R. peniculata* R. Parker, 14 (.015); *Sarcophaga haemorrhoidalis* (Fallen), 5 (.005); *S. cooleyi* R. Parker, 7 (.008); *Boettcheria cimbicis* (Townsend), 1 (.001). *Anacampta latiuscula,* 5 (.005); *Culex tarsalis* Coquillett, 9 (.01). Species of *Borboridae* and of *Scatopse* were very numerous, but of course no record of them could be secured by means of Hodge traps.

The above data indicated the great predominance of house flies during the summer months, even under out-door conditions. Their comparative abundance may be expected to be even greater under less rural conditions. The abundance of species of *Fannia,* particularly *scalaris,* and of the blow flies would likely be less in towns having adequate systems for the

care and disposal of garbage. Insanitary privies also permitted the breeding of *Fannia scalaris* and other coprophagous flies in much greater number than would have been the case if privies had been fly-proof. The species of *Sarcophagidae*, which were more numerous than the data indicate, are also far more numerous under rural and semi-rural conditions. It will be seen from the table that *Muscina stabulans* was second in abundance and showed a continual decrease during the summer months. In the spring it is frequently more commonly seen in houses than *Musca domestica*. The species of *Lucilia*, *Calliphora* and *Fannia* also show a decrease in numbers during the period of the experiment, though all show some increase early in August. *Phormia regina* remained about constant. It is uncertain just how accurate an index of the comparative abundance of the various species is afforded by the data presented. The beer used for bait was doubtless more attractive to some species than to others.

As noted at Powderville, Montana, during the season of 1916, blow flies were most abundant during the spring. *Phormia terraenovae* and a species of *Cynomyia*, probably *elongata* Hough, were predominant during the spring months and were followed by species of *Calliphora*. *Phormia regina* and *Calliphora coloradensis* were the more common species in July and August. A knowledge of the seasonal occurrence of the blow flies is likely to be of some value in connection with the blowing of wool at lambing time though at present the species of these flies responsible for this trouble in Montana are not known.

Change of Address.

Dr. Edwin C. Van Dyke, of the Entomological Department of the College of Agriculture of the University of California, will exchange positions temporarily with Dr. J. C. Bradley, of Cornell University. Dr. Van Dyke will leave Berkeley on June 1, 1917, and his address from June 18, 1917, to February 1, 1918, will be Department of Entomology, Cornell University, Ithaca, New York.

ENTOMOLOGICAL NEWS.

PHILADELPHIA, PA., JUNE, 1917.

The National Defense Against and By Insects.

Following out the plan of co-operation proposed by the National Bureau of Entomology to State, Station and other Entomologists, as outlined in Dr. L. O. Howard's letter published in the NEWS for May, (page 229), the Federal Bureau has issued Number 1 of its reports of the "Emergency Entomological Service," dated May 1, 1917, in mimeographed form. It states that

> Very gratifying replies have been received to the various letters which recently have been addressed to entomologists throughout the country regarding the great importance of reducing as far as possible, to meet the present emergency, the losses which are caused by insect attack on the staple crops of the country. Sympathetic and hearty co-operation has been promised by all entomologists of the country. . . . . It is especially important that during May and June any indications of insect outbreaks be reported promptly by entomologists on account of their bearing on subsequent injury.

Suggestions and reports from twenty State and Station Entomologists from New York to Florida and west to Montana and California are included in this report, along with those emanating from the Federal Bureau, from which we make some quotations:

> The Hessian Fly situation throughout the main wheat belt at the present time appears to be reassuring. . . . . Considerable infestation still exists throughout the southern part of Illinois and Indiana, in Missouri, northern Oklahoma and eastern Kansas, but the situation can not be considered acute . . . . in some of the central counties of Kansas the loss from the Hessian fly this year will be very heavy.
>
> An extensive flight of May beetles . . . . is expected to occur during the month of May throughout the northern portions of the United States. The focus of this flight appears to be the State of Michigan. . . . . This means a great infestation of grubs during the summer and early fall of 1918.
>
> It is very probable that heavy losses from [the chinch bug] may occur during the coming season in the middle west.
>
> The corn leaf aphis is more than usually abundant in the Southwestern States at present.
>
> Mr. R. S. Woglum reports that there is prospect of greater damage than usual from the principal citrus scale insects in Southern California. Many scale infested orchards were not fumigated last season, owing to the lack of cyanide, which continues.
>
> Mealy bug damage in California is apparently on the increase.
>
> The high cost of materials entering into the composition of insecti-

cides has caused a marked increase in price of certain largely used articles, such as Paris green, arsenate of lead, etc., and may operate against the desired more general utilization of these materials in the protection of crops from insects. An important saving can usually be effected in the consolidation of orders for insecticides for a given neighborhood, or their purchase through fruit-growers' associations, or other co-operative buying organizations. The importance of this saving is realized when it is remembered that the difference in cost of certain insecticides, as arsenate of lead, in small packages at retail stores over its cost in larger quantities from manufacturers or jobbers, is often 100 per cent. [Suggestions for cheaper arsenicals are given.]

We may logically fear that we shall have considerable trouble with grasshoppers, blister beetles and crickets during the coming year [in South Dakota.]

The codling moth and the peach curculio show indications of extensive injury [in Texas].

Circulars are being sent direct to bee-keepers in the chief producing regions urging them to increase production by increasing the number of colonies in so far as it can be done without decreasing the crop, but especially by manipulating their bees in the best manner. . . . . In parts of the Northwest, winter losses were excessive and arrangements are being made to have bees sent from the south to replace the loss, since prospects for a crop are poor in parts of the southwest. Crop prospects are good in most of the northern states.

Dr. Felt writes us that Dr. Vaughan, Chairman of the Medical Committee of the National Research Council, has reported in favor of an expert entomologist being attached to every army camp and the above quoted report states that the Federal Bureau has

prepared the manuscript of a brief popular bulletin on insects which are of importance in military operations which will be printed in a short time. The Chief of the Bureau has been conferring with the General Medical Board of the Council of National Defense concerning the organization and utilization of the medical entomologists of the country.

The Bureau hopes to send out this series of reports at least monthly through the summer and autumn.

Notes and News.

ENTOMOLOGICAL GLEANINGS FROM ALL QUARTERS OF THE GLOBE.

A New Biological Journal.

Beginning May 15th, *Psychobiology* will appear every second month and will include in the yearly volume approximately 600 pages. Its pages will be devoted primarily to research which lies in the field common to psychology and the several biological sciences, or which has a distinct bearing on the biological foundations of psychology. No

formal limit of length has been imposed on contributors, but short articles will be preferred, and unnecessary length will be considered a bar to publication.

While the function of the journal will be primarily to promote the speedy publication of research, discussions of important points may be admitted at the discretion of the editors, such discussions being limited in any case to two pages.

Books will not be reviewed but brief notices may be given of books which are deemed sufficiently important. Each book sent for notice should be accompanied by a concise statement of its purposes and contents.

Manuscript submitted for publication should be addressed to Professor Knight Dunlap, The Johns Hopkins University, Homewood, Baltimore, Md., or may be submitted through one of the Associate Editors: John J. Abel, Johns Hopkins Medical School; Walter B. Cannon, Harvard Medical School; Raymond Dodge, Wesleyan University; Shepherd I. Franz, Government Hospital for the Insane; Herbert S. Jennings, Johns Hopkins University, and George H. Parker, Harvard University.—KNIGHT DUNLAP.

The Generic Bugbear.

Those who refrain from subdividing large genera, on the ground that they are facilitating the remembrance of names, are likely to exaggerate the importance of their services. Such persons do not convince me of anything, except that they have never really learned enough names to be able to tell whether many generic names hinder or help. A man can write a monograph containing one hundred species to the genus without being able to name all of the species offhand and without being a judge as regards the easy remembrance of names.

The idea that few generic names facilitate remembering is not a fact, and, even if it were true, would be worthless in practical application. You can remember one generic name better than a dozen, but you can not remember one hundred names in one genus as easily as you can one hundred names in a dozen genera. A biologist who is working with a number of species where he has to identify and write the names frequently can remember them more easily than the names of persons. The generic name does not increase the difficulty of remembering the name of a species any more than the surname increases the difficulty in remembering the name of a man. If every one hundred of your acquaintances had the same surname, do you think you could remember their names more easily?

Suppose you start out to familiarize yourself with the flowers of your neighborhood and their insect visitors. If it is like the neighborhood of Carlinville, you will have to learn a generic name for every 1.7 species. Or suppose you undertake to write offhand the names of the

insects of New Jersey. You will have to learn a generic name for every 2.6 species. The lumpers will have to strain themselves to make the average 2 at Carlinville and 3 in New Jersey. The trouble with the taxonomists who object to genera is that they have adopted the wrong study. They ought to take up some subject where many names are not required. If they distinguish groups which they will not designate with single words, their generic determinations are probably erroneous, and some one else ought to follow them up and name their groups for them, just as Latreille did for Kirby.—CHARLES ROBERTSON, Carlinville, Illinois.

Entomological Literature.

COMPILED BY E. T. CRESSON, JR., AND J. A. G. REHN.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species, will be recorded.

The numbers in **Heavy-Faced Type** refer to the journals, as numbered in the following list, in which the papers are published.

All continued papers, with few exceptions, are recorded only at their first installments.

The records of papers containing new species are all grouped at the end of each Order of which they treat. Unless mentioned in the title, the number of the new species occurring north of Mexico is given at end of title, within brackets.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

4—The Canadian Entomologist. **6**—Journal, New York Entomological Society. **13**—Comptes Rendus, Societe de Biologie, Paris. **50**—Proceedings, U. S. National Museum. **79**—La Nature, Paris. **87**—Bulletin, Societe Entomologique de France, Paris. **177**—Quarterly Journal of Microscopical Science, London. **179**—Journal of Economic Entomology. **189**—Journal of Entomology and Zoology, Claremont, Calif. **195**—Bulletin, Museum of Comparative Zoology, Cambridge. **304**—Annals, Carnegie Museum. **324**—Journal of Animal Behavior, Cambridge. **410**—Journal, Washington Academy of Sciences. **411**—Bulletin, The Brooklyn Entomological Society. **420**—Insecutor Inscitiae Menstruus: A monthly journal of entomology, Washington. **529**—Journal of Zoological Research, London. **538**—Lorquinia, Los Angeles. **540**—The Lepidopterist, Official Bulletin, Boston Entomological Club.

GENERAL SUBJECT. Needham, J. G.—The insect drift of lake shores, **4**, 1917, 129-37.

MEDICAL. Howard, L. O.—The carriage of disease by insects, **410**, vii, 217-22.

ARACHNIDA, ETC. Moles, M. L.—Another record of a small

whip scorpion in California, **189,** ix, 1-7. **Nisbet, J.**—Solpugids from the Claremont-Laguna region, **189,** ix, 22-29.

Chamberlin, R. V.—New spiders of the family Avicularüidae [many new], **195,** lxi, 25-75.

NEUROPTERA, ETC. Bagnall, R. S.—On a collection of Thysanoptera from St. Vincent, with descriptions of 4 n. sps., **529,** ii, 21-27. **Walker, E. M.**—Some dragonflies from Prince Edward Island, **4,** 1917, 117-19.

ORTHOPTERA. Bugnion, E.—L'accroissement des antennes et des cerques de la blatte (Blatta americana), **13,** lxxx, 317-24. **Caudell, A. N.**—Some interesting O. from Mexico, **420,** v, 28-9. **Fox, H.**—Field notes on Virginia O., **50,** lii, 199-234. **Merle, R.**—Le cyphocrane geant, Etudes biologiques de M. Foucher, **79,** 1917, 113-117.

HEMIPTERA. Davis, W. T.—Two new Cicadas from Lower California, Mexico, **6,** xxv, 6-10. **Hempel, A.**—Catalogos da fauna Brazileira III. As coccidas do Brazil, 75 pp. (Ed. Museu Paulista, Brazil). **Hungerford, H. B.**—Food habits of corixids, **6,** xxv, 1-5. **Oslen, C. E.**—Concerning Gerris remigis, **411,** xii, 21. **Smith, H. S.**—On the life history and successful introduction into the U. S. of the Sicilian mealy-bug parasite, **179,** x, 262-68. **Weiss, H. B.**—The status of Lecanium corni in New Jersey, **4,** 1917, 119-20.

Davidson, W. M.—Little known western plant lice, II. [2 new], **179,** x, 290-97. **de la Torre Bueno, J. R.**—A n. sp. of tingid from New York, **411,** xii, 19-20.

LEPIDOPTERA. Dyar, H. G.—A note on Cisthene; The Barnes & McDunnough "List," **420,** v, 8-10; 41-4. **Eastman, W. F.**—What is A1 quality? **540,** i, 39. **Forbes, W. T. M.**—The genera of Hydriomeninae of the U. S., **6,** xxv, 44-67. **Heinrich, C.**—Generic description of larva of Anegcephalesis, **420,** v, 48-50. **Knetzger, A.**—Entomological notes: a strange case of pupation; a peculiar case of oviposition, **540,** i, 38. **Mabille & Boullet**—Description d'hesperides nouveaux, **87,** 1917, 97-101. **Malcolm, G.**—Variation in lepidoptera, **538,** i, 70. **Rau, P.**—The courtship of Pieris protodice, **324,** vii, 143-4.

Bird, H.—New sps. and histories in Papaipema, No. 19 [2 new], **4,** 1917, 121-28. **Dyar, H. G.**—Three new No. American Phycitinae; A new Phycitid from the Bahamas; A new Noctuid from Brazil, **420,** v, 45-6; 46-7; 50-1.

DIPTERA. Dyar & Knab—Bromelicolous Anopheles, **420,** v,

38-40. **Malloch, J. R.**—Predaceous habit in Madeterus and Psilopa, **411,** xii, 13-14.

Cole, F. R.—Notes on Osten Sacken's group "Poecilanthrax" with descriptions of n. sps. [5 new], **6,** xxv, 67-80. **Dyar, H. G.**—The mosquitoes of the mountains of California [1 new], **420,** v, 11-21. **Howard, Dyar & Knab**—The mosquitoes of North and Central America and the West Indies. IV. Systematic description, Pt. II. (Carnegie Institution of Washington. Pub. No. 159, Vol. IV, 525-1064.) **Johnson, C. W.**—A new maritime anthomyid, **4,** 1917, 148. **Townsend, C. H. T.**—A synoptic revision of the Cuterebridae, with synonymic notes and the description of one n. sp., **420,** v, 23-28.

COLEOPTERA. Angell, J. W.—Notes on Lucanidae, **411,** xii, 22. **Chittenden, F. H.**—The two-banded fungus beetle, **179,** x, 282-87. **Hayes, W. P.**—Studies on the life-history of Ligyrus gibbosus, **179,** x, 253-61. **Hyslop, J. A.**—Notes on an introduced weevil (Ceutorhynchus marginatus), **179,** x, 278-82. **Leng, C. W.**—Cardiola obscura on Staten Island, **6,** xxv, 80-1. **Nicolay, A. S.**—Synopsis of the Anthophilax of No. America, **6,** xxv, 38-44. **Williams, F. X.**—Notes on the life-history of some No. American Lampyridae, **6,** xxv, 11-33.

Blatchley, W. S.—On some new or noteworthy C. from the west coast of Florida [6 new], **4,** 1917, 137-43. **Fall, H. C.**—The eleventh Pleocoma, **41,** xii, 15-16. **Leng, C. W.**—A new variety of Scaphinotus, **6,** xxv, 34-6. Synopsis of the species of Arthromacra [2 new], **411,** xii, 16-19. **Van Dyke, E. C.**—A new sp. of the genus Anthophilax, **6,** xxv, 36-7.

HYMENOPTERA. Busck, A.—Notes on Perisierola emigrata, a parasite of the pink boll worm, **420,** v, 3-5. **Cockerell, T. D. A.**—Some euglossine bees, **4,** 1917, 144-6. **Ducke, A.**—As Chrysididas do Brazil (Catalogos da fauna Brazileira), iv, 31 pp. **Gatenby, J. B.**—The embryonic development of Trichogramma evanescens, monembryonic egg parasite of Donacia simplex, **177,** lxii, 149-188. **Holland & Rohmer**—List of the H. collected on the Isle of Pines by G. A. Link, 1912-13, and contained in the Carnegie Museum, **304,** xi, 291-96. **Muir, F.**—On the synonymy of Delphax maidis, **4,** 1917, 147. **Sladen, F. W. L.**—Collecting wasps and bees, **4,** 1917, 113-17.

Girault, A. A.—The occurrence of the genus Parachrysocharis in the U. S. [1 new], **4,** 1917, 129. Notes on chalcid flies, chiefly from California [7 new], **189,** ix, 8-12. The No. American species of Euchrysia females [1 new], **411,** xii, 14-15. A chalcid parasite of the pink boll worm [1 new], **420,** v, 5-6. **Rohwer, S. A.**—Two bethylid parasites of the pink boll worm [1 new], **420,** v, 1-3.

EXCHANGES.

This column is intended only for wants and exchanges, not for advertisements of goods for sale. Notices not exceeding three lines free to subscribers.

☞ These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and only when necessary those at the top (being longest in) are discontinued.

Wanted—Hesperiidae from all parts of North America. Will pay cash or exchange Iowa insects. A. W. Lindsey, 112 E. Bloomington St., Iowa City, Ia.

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